VOL. LXXXVI. No. 2219. [All Rights Reserved.] JUNE 4, 1920. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of Postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom and Canada, £1 12s. 6d. per annum.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOIVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageckay, Cent., London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

LITHOLITE INSULATORS, Ltd.
65—57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 692, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED NEARLY 20 YEARS.

Birkby's **"ELO"**
For all purposes for which moulded insulation is required specify "ELO"—which is water, oil and fireproof.
FLEMING, BIRKBY & GOODALL, LTD., LIVERSEDGE, YORKSHIRE.

WRIGHT 'Phone: 490. Tel.: Motor.
A.C. and D.C. **MOTORS.**
WRIGHT MOTORS, Ltd., HALIFAX.

EVERY DESCRIPTION OF
SMALL TURNED PARTS and CASTINGS for ELECTRICAL ENGINEERS.
A. MORTON,
6, Tenby Street North, Birmingham.

BROOK
ONE, TWO and THREE-PHASE
MOTORS.
See Sup. 46.

SWITCHGEAR
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors,
GREENLAND PLACE, CAMDEN TOWN, LONDON

MICA & MICANITE
TAYLOR & PETTERS, LTD.,
40, Hatton Garden, London, E.C. 1.
'Phone: 4575 Central. See Page ii.

MOTORS. • DYNAMOS.
VICTORIA DYNAMO & MOTOR CO.
CRAVEN HOUSE,
Kingsway, London, W.C. 2.
'Phone: Gerrard 1945.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

SKATOSKALO BOILER SCALING TOOLS.
Sole Maker:
FRANK GILMAN,
9, Westfield Road, BIRMINGHAM.
See Advertisement this week, page xxxvii.

"EMPIRE" AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C. 2
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement last week, p. vi.

CONNOLLY'S (BLACKLEY), Ltd.,
for
WIRES AND CABLES.
See Advertisement this week, p. iii.

WHITE
Electrical Instrument Co., Ltd.
2, 4 & 6, GLOUCESTER ST., CLERKENWELL, LONDON, E.C. 1.
Wire: Voltograph, London. 'Phone: City, 8660.

ELECTRIC MOTORS.
One, Two and Three-Phase.
BRITTAIN'S ELECTRIC MOTOR Co.
(Late Langdon-Davies Electric Motor Co.),
110, Cannon Street, London, E.C. 4.

INSULATING -- BEADS --
Immediate Delivery.
HOLDER-HARRIDEN LTD., 35/37, Noble St., London, E.C.

THE CALL FOR CABLES.
See page xi.

Better than Rubber, Leather and Gutta-Percha.
HOSE.
DERMATINE
DERMATINE CO., Ltd.,
Neate St., London, S.E. 5

SHUNT REGULATORS.
MOTOR STARTERS and all classes of Resistance Work.
REPAIRS TO ANY MAKE **MOTOR STARTERS.**
THE SOLENOID REGULATOR CO.,
HIGHGATE SQUARE, CAMP HILL,
Telephone: Midland 582. **BIRMINGHAM.** Telegrams: "Solenoid, Birmingham."

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

ELECTRIC MOTOR REPAIRS.
ARMATURES REWOUND.
H. DUNN & SON,
Newington Causeway,
Tel.: Hop. 1167. LONDON, S.E. 1

RAYNER & HEALD, LTD.,
DUKE STREET, DERBY.
TWO & THREE-PHASE MOTORS only.
See page xxxv.

FULLER'S UNITED ELECTRIC WORKS, LIMITED,
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES CARBONS, &c.
WORKS: CHADWELL HEATH, ESSEX.
General Sales Offices:
IDDESLEIGH HOUSE, Caxton St., Westminster.
'Grams: Blodbat, Vic, London. 'Phone: Victoria 6865-4

INGLEBY & CO.,
ELLAND ROAD, LTD.
MOTORS *LEEDS.*
FOR DIRECT AND ALTERNATING CURRENT
Tel. 378.
Delivery from Stock up to 50 H.P.

Advertisement Index, see page xxxvi.

ENGLISH EDISWAN EVERYTHING ELECTRICAL

The house of Ediswan is the best equipped to deal with all enquiries for

Everything Electrical.

ENTIRELY BRITISH.

The Edison Swan Electric Co., Ltd.
PONDERS END, MIDDLESEX.
London and Provincial Depots.

WE have the finest Plant in the country for the Quality Production of small components, such as screws, studs, connecting-rod bolts, eye-bolts, &c.

We shall be pleased to quote for large or small quantities upon receipt of drawings or sample.

"THE COVENTRY"
REPETITION CO. LTD.
COVENTRY.
Telegrams: REPETITION.

MICA & MICANITE

INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE 4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."

TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C.1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.

ARMSTRONG, STEVENS & SON, Ltd.,

WHITTALL STREET,
BIRMINGHAM.

PRICE LIST ON APPLICATION.

Telephone: CITY 3115. Telegrams: "VANDUARA, CENT. LONDON."

Contractors to H.M. Government.

ELECTRICAL INSULATING **TAPES, WEBS, CORDS, SLEEVING, &c.**

DELIVERY FROM STOCK.

JOHN MACLENNAN & CO.,

115, NEWGATE STREET, LONDON, E.C.1, AND AT 168, INGRAM STREET, GLASGOW.

THE

ELECTRICAL REVIEW.

VOL. LXXXVI. JUNE 4, 1920. No. 2,219.

ELECTRICAL REVIEW.

Vol. LXXXVI.] CONTENTS: June 4, 1920. [No. 2,219.

	Page
The Electro-Deposition of Iron	705
German Electric Tramways	706
"Situations Vacant"	706
A Modern All-Electric Country House, by T. B. Wright (*illus.*)	707
Cable-Fault Localisation, by E. Raymond-Barker (*illus.*) ...	709
"Wired Wireless" Telegraphy and Telephony	710
The Electrification of Holland (*illus.*)	711
All-British Switchgear (*illus.*)	713
Correspondence—	
Composition *v.* Porcelain Insulators	713
Mutual Discussion	714
The Policy of the E.P.E.A.	714
"Situations Vacant"	714
The Efficiency of Domestic Electric Heating	714
Business Notes	715
Notes...	723
City Notes	725
Stocks and Shares	727
Market Quotations	728
What is the Contractor Doing?	729
The Foreman in the Engineering Industries, by H. Seymour	730
Power Factor from the Business Man's Point of View, by C. Turnbull	730
Gas Turbine Development (*illus.*)	731
The Electrical Equipment of Artisan Dwellings	732
New Electrical Devices, Fittings and Plant (*illus.*)	735
New Patents Applied for, 1920	736
Abstracts of Published Specifications	736
Contractors' Column ... ... Advertisement page xxvi	

"ELECTRICAL REVIEW" SUBSCRIPTION RATES.

UNITED KINGDOM and CANADA £1 12 6 per annum.
COLONIAL and FOREIGN .. .. 2 1 6 do.
Postage Free.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEKKAY, CENT., LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O Box 392.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd. Manning Chambers; Gordon and Gotch 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LTD., and crossed "London City and Midland Bank, Newgate Street Branch."

THE ELECTRO-DEPOSITION OF IRON.

ALL users of machinery have been concerned on occasions at the necessity for scrapping important and valuable parts owing to a small portion having become worn. In high-speed machinery, such as aeroplanes and internal-combustion engines, and also in connection with guns, during the war, this became a serious problem, and considerable progress was made in developing the process of the electro-deposition of iron upon the worn parts. This not only had the effect of saving valuable parts from the scrap heap, but the saving in time and the greater speed in getting aeroplanes, guns, &c., back again into action, was of even greater importance. In commercial engineering of all kinds the process of electro-deposition of iron should find an important place, although, so far as we have been able to ascertain, the application of the process on a commercial scale is only being attempted to a small extent.

Yet quite a considerable amount of research has been carried out upon it, and much valuable practical experience was obtained in the Motor Transport and R.A.F. repair depôts in France, and also at Farnborough. The practical repair work by means of the process in the field was necessarily of a more or less unscientific nature viewed from the standpoint of the laboratory research worker, but the greatest possible credit is due to certain officers whose enthusiasm led to really wonderful results in the face of difficulties from both outside and inside. It was found possible, for instance, to deposit a layer of iron up to about 2 mm. in thickness on any simple cylindrical surface of wrought iron or steel, mild or cast, and although, in a paper just read before the Iron and Steel Institute*, Mr. W. E. Hughes, late chief research chemist to the Electro-Metallurgical Committee of the Ministry of Munitions, points out that the work was not done under proper scientific control, and that the results, although apparently satisfactory, were very far from being so in fact, an earlier paper before the Institution of Automobile Engineers, by Major B. H. Thomas, described the conditions under which the work in the field was carried out, which were very different from those obtaining in a laboratory. At the same time, Mr. Hughes did not intend his comment to be taken as adverse criticism, but only as pointing out some of the defects which may occur unless workshop conditions, in commercial practice, are much more scientific than they were, of necessity, under war conditions.

The necessity for quickly building up worn parts made itself felt in 1915, and in the third heavy motor transport repair shop in France, the process was applied under difficulties. The solution which was found to yield the best results was made up of ferrous ammonium sulphate at a strength of 75 grammes per litre of water, with a current density of 0·1 ampere per 30 sq. cm. The rate of deposition was 0·005 mm. thickness per hour, and the operation was carried out in separate vats of approximately 30 litres capacity. The general method of operation was to suspend the work in a vertical position in the vat,

* ELECTRICAL REVIEW, May 28th, p. 681.

by means of standards fixed to the bench, which were provided with universally jointed arms fitted with clamps at the end to hold the work. The anode was then suspended from a rocker arm, and made to surround the work concentrically as, especially with thick deposits, it appears to be important to keep the anode as nearly as possible equidistant from the work at all points. The anodes were made of Swedish iron wire about 16 s.w.g., thoroughly annealed and wound into the form of a woven cylinder. They were suspended and stiffened by means of a ¼-in. iron rod on one side, which was attached at the top to the rocker arm. The anodes were fitted, in addition, with two celluloid cones to produce an upward pumping action. The effect of this action was found to be important, as it is essential to avoid having stagnant solution in contact with the work, and it is also desirable to keep the ferrous carbonate in the solution in a state of suspension. Some difference of opinion existed between the motor transport repair officers and the R.A.F. repair officers as to whether it was better to deposit the metal direct or on a thin film of copper. The latter view was held by the R.A.F., but on the other side, the efficacy of such a method was contested. The R.A.F. people apparently found that good results followed the practice of applying a thin film of copper and then a layer of iron, repeating the process when greater thicknesses were required. However, the advantages of one method over another are subjects for investigation and experiment. The point is that the work which was carried out during the war has opened up a prospect of considerable economies for machinery users by electro-deposition, and it is to be hoped that this valuable experience, gained at the public expense, will not be allowed to be wasted. It is improbable that private individuals in normal times would have been able to undertake such work, and good use should now be made of it.

German Electric Tramways.

It has been known for a long time past that conditions in connection with the electric tramways in Germany have been going from bad to worse, and the situation with regard to many undertakings is now becoming desperate. The chairman of one of the principal electrical manufacturing companies, which is also interested in a number of tramways, recently stated that nothing further could be gained by increasing fares. This statement is more than confirmed by the directors of a tramway company in Rhineland. They point out that it has been necessary to have recourse to raising fares in order to meet the increase in working expenses, but in this respect they have been opposed by the local authorities, who have placed great difficulties in the way of the introduction of higher fares. On the other hand, the municipal tramway fares have been advanced time after time, and in some cases the municipal councils have also increased the rates in order to endeavour to relieve the tramways—at the expense of the ratepayers in general. It is now proposed to attempt to solve the question of fares by arbitration, as in the case of the fixing of charges for the supply of energy, but experience has shown lately that increases in fares, far from yielding a larger revenue, are actually resulting in a decreased income.

The new advances made in the prices of coal with the consequential rise in the prices of materials, &c., will further prejudicially affect the working of the tramways. The charge made for power before the war to tramways not having their own generating stations, ranged from 5 to 10 pfennigs per KW.-hour; it now amounts to 40 to 50 pfennigs, and will further advance in the next few weeks, owing to the higher cost of coal. The question of introducing minimum fares of 60, 70, or even 80 pfennigs has been discussed by a number of tramway managements, but these have been vetoed by municipal bodies, on the ground of political considerations, recourse being again had to the indirect method of increased rates and taxes.

Some interesting examples are given in order to demonstrate the great increase in the cost of permanent-way material, rolling stock, &c., during the war. For instance, the sale price of tramway rails, which amounted to 139 marks (£6 19s.) per ton on the outbreak of war, reached 300 marks in March, 1919, and is now 3,200 marks per ton. The price of copper has risen from 1·50 to 52 marks per kilogramme in the same period of years; and the cost of a motor-tramcar has advanced from 15,000 to 200,000 marks, while the cost of maintaining or renewing the surface of the tramway tracks has also enormously increased. It is contended that the tramways can no longer continue to meet the heavy expenditure, and that they will be brought to a standstill in the near future—as has already taken place in the case of both private and municipal lines of minor importance—unless an improvement is brought about in some form or another.

"Situations Vacant."

In our "Correspondence" columns to-day, "J. C." approaches the vexed question of "Box numbers" and their associations from a somewhat novel point of view. As regards the inability of the applicant to guess at the identity of the advertiser, we may point out that our Advertising Department makes provision for the case in which the applicant desires that, if the advertiser is, say, "Mr. X," his letter shall not be forwarded to that quarter—such letters are destroyed. Again, the failure to acknowledge the receipt of replies to an advertisement, and to inform unsuccessful applicants as to the result, shows a lack of ordinary courtesy to which we have previously drawn attention; why should a man who answers an advertisement, but fails to secure selection, be treated as though he were a dog? To our mind the practice is a serious breach of good manners. The neglect to communicate with an applicant who has been granted an interview, and whose hopes have been raised thereby, is a still graver discourtesy, and may involve serious injury to the victim's interests, for he may refuse good openings whilst waiting in the confident expectation of securing the appointment. He has a clear right to be informed of his fate as soon as possible after the decision is made.

But the main point which our correspondent makes is of graver import. The suspicion that employers who are members of certain great associations have secret arrangements for preventing members of their staffs from moving from one firm to another within the same association, whether well-founded or not, has in the past given rise to much bitter feeling, and if it were justified in fact, would constitute not only a gross and illegal infraction of the rights of a free man, but also would be fraught with dire results to British industry in the long run. Our best and most worthy engineers and artisans would miss no opportunity of transferring their services to some country where freedom could still be found; to remain here under such a tyrannical *régime* would be unbearable.

Such suspicions, as our correspondent says, if not true should be allayed, and his suggestion that the subject should be brought to the notice of the Joint Industrial Councils is very commendable. It can, however, apply only to the case of members of Trade Unions, for the Councils as yet afford no representation to members of technical staffs, and the only instance in which this omission has been rectified is that of the staffs of power stations, who now have their Joint Industrial Board. So far as the field remains uncovered, apparently, we must look to the Society of Technical Engineers for appropriate action; and we are so frequently asked nowadays what that society is and what it is doing, that we suggest to its directors the desirability, or even the necessity, of its abandoning, at least in part, its customary secretiveness and telling the public something more of its aims and work.

A MODERN ALL-ELECTRIC COUNTRY HOUSE.

By THOS. B. WRIGHT, A.M.I.E.E.

In December, 1918, the writer was instructed to prepare a scheme for lighting, heating and cooking required at a large country house, and told that it was all to be done with water power. In January, 1919, a few days were spent on the job, taking particulars, and principally surveying and levelling off the various alternative water-power schemes. Work was actually started early in February, and the installation was working on August 4th, 1919.

So far as we know, this is the first large completely electrical country house in the kingdom.

The Dam, from Up-stream side.

View of Dam, showing Overflow and Intake Tank.

The river passes near the house and is fast flowing, running in a rocky ravine, and is subject to very rapid rise and fall. It is fed by many good springs and a large hill loch.

A 6-ft. dam wall is built across the river, about 25 ft. thick at bottom and sloping up to about 6 ft. thick at top. The overall length is about 65 ft., and both ends are securely built into the solid rock. At the high end of the dam, starting behind the centre line is built a large concrete intake tank measuring 11 ft. 4 in. by 8 ft. 3 in,, connected to the reservoir by a concrete duct about 6 ft. long by 4 ft. wide and 2 ft. 6 in. high. A heavy rough bar iron strainer of about 80 sq. ft. area is fitted outside this duct, in addition to a large cast-iron gate sluice. Inside the intake tank is the fine strainer made of perforated cast-iron plates.

From the intake tank about 260 ft. of 26-in. bore riveted steel pipe is carried on stone piers built on the river bank to a concrete connection tank, with manhole, and from this tank about 800 ft. of 27-in. bare special rock concrete pipes are carried underground to a second concrete tank with manhole. The head of water on this tank is about 20 ft. The relief pressure open-ended concrete pipe is taken from the base of this tank.

About 200 ft. of 26-in. bore riveted steel piping is carried on concrete piers downhill to the power house, special anchorage arrangements being made for the piping, which ends in a large cast-iron "Y" bend, each tail having a large slow-acting sluice-valve fitted.

The measured head is 96 ft., including 17 ft. of suction tail piping. The suction pipe discharges vertically into a concrete duct, from which the water returns to the river.

At present one turbo-dynamo set of 110 B.H.P., consisting of a Gilkes Francis turbine and an E.C.C. dynamo, is installed, and a second set of 50 B.H.P. is on order. The working pressure is 250 volts, but the generators are over-compounded to give from 250 volts at light load to 265 at full load. An oil governor is provided.

The main power house switchboard is built up of heavy marble slabs mounted in angle-iron framework, two panels control the generators, and a third panel the outgoing mains. The usual meters, switches, and fuse gear, &c., are fitted on each panel.

Three pairs of V.I.R. cables in tubing connect the switchboard with the outside overhead line. This line consists of three pairs of 37/14 S.W.G. bare copper wires run on poles about 20 ft. above ground level, protected at both ends by lightning arresters. The overhead line is about 300 yards in length, after which a pair of 0·5 sq. in. bitumen cables are laid solid to the house, a distance of about 210 yards.

Steel Pipe Line below Intake.

Concrete Pipe Line.

At the house the cables terminate at the main switchboard. This board has four heavy main switches (controlling the lighting, radiators, power, and cooking panels), and separate panels for the various meters, switchgear, and sub-fuses. A recording ampere-meter is fitted, from which most interesting records are being taken.

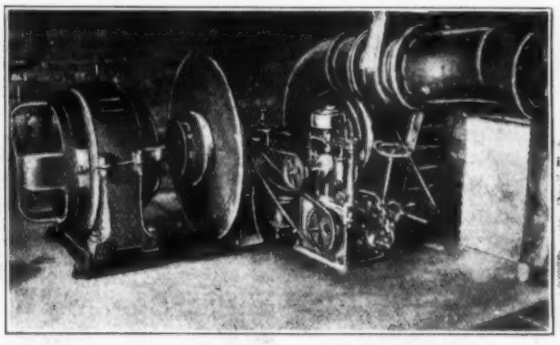
The switchboard is of polished white marble, and is

mounted with free access to all parts both back and front. The whole of the wiring work is carried out with C.M.A. cables run in heavy screwed steel tube in the contractor's usual standard manner.

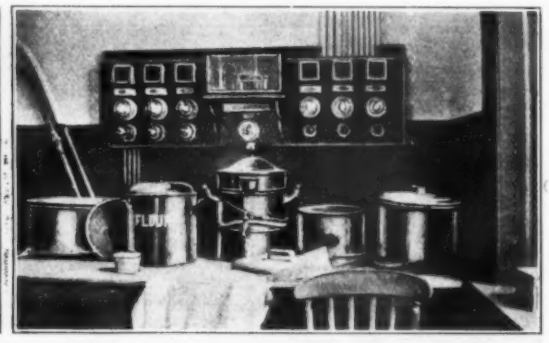
The heating installation consists of about thirty 20-amp. radiator sockets and switches, fitted in all cases in special iron boxes in the skirtings, with brass face plates. Double-pole diamond H switches are used throughout. Each radiator socket forms a separate circuit from the main board. The radiators are generally of 3-KW. capacity each, with three-heat control, having elements made up of flat wire wound on mica. The heating of the house is much better than when coal fires were used. Normally the radiators are turned on full for from half an hour to an hour, then turned to half heat.

with four 8-in. 1,100-watt and two 6-in. 600-watt hot-plates in addition to a plate-warmer and a 15-in. by 10-in. grill loaded to 2,000 watts. Each separate unit has three-heat regulation fitted. All switches, fuses, and indicators are mounted on iron barrel standards above the range. Two fish kettles or stewing pans are fitted, one of 18 in. size, and one of 22 in. size, and in addition a baker plate and various sizes of boiling pans, both lined and unlined, are provided. A hot closet loaded to 1 KW. is fitted in the pantry, close to the dining-room service door. Small table sets of toasters, egg boilers, coffee pots, &c., are also in use.

Special circuits are fitted for the motor washing machine, ironing machine, mangle and drying room, and in the laundry for the usual hand electric irons. The heating apparatus is mostly of the Falkirk make.



GILKES-E.C.C. TURBO-DYNAMO, WITH OIL GOVERNOR.

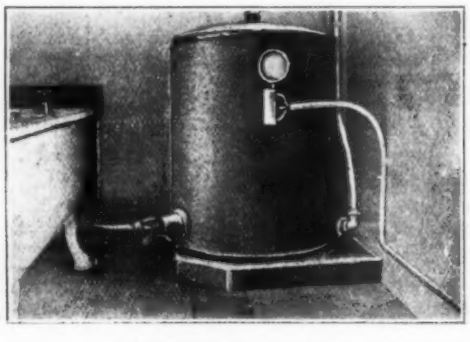


SCULLERY SWITCHBOARD FOR COOKING APPARATUS, AND CALORIFIER RELAY.

For water heating four calorifiers are used. One of 70 gallons capacity supplies hot water to the kitchen, scullery, wash-house, pantry, and to two dressing rooms and bathroom overhead. Another of 70 gallons capacity is erected in a clothes drying-room—where its waste heat is used—and supplies two bathrooms and four lavatory basins.

One of 50 gallons capacity is fitted in the principal dressing-room, supplying bath, basin, &c., and another of 50 gallons capacity is fitted on the top floor, supplying a bathroom and basins there. Two instantaneous water-heating geysers are fitted experimentally, but these are not needed.

The 70-gallon calorifiers are each fitted with immersers of 8 KW., but normally only 6 KW. are used. The 50-gallon calorifiers are each fitted with immersers of 6 KW. All the calorifiers are fitted with thermo-control double-action



FIFTY-GALLON CALORIFIER.

switchgear, combined with a double-coil relay which makes and breaks the main current in mercury cups. The thermo-switch and relay are operated by means of a battery of dry cells. The water is always maintained at a constant pre-arranged temperature of 170° F., night and day, but could equally well be kept at any desired temperature less than boiling point.

The cooking apparatus consists of one double oven range, each oven being provided with three-heat regulation. Each oven is loaded to 3 KW. capacity, and the internal size is 18 in. × 18 in. × 14 in. The hot table above is fitted

The estate cottages and offices are also being lighted and heated in the same way, and provided with electric cooking.

The whole of the arrangements have been worked out in such a way that one of the estate men is able to attend to the running of the installation, in addition to his other duties. The turbines run night and day. The running cost, therefore, is very small, and is made up of part of this man's wages plus the cost of lubricating oil, and a periodical inspection visit of a skilled man every four months.

The maintenance cost so far has been nothing, no renewals of any kind having been supplied. All the elements used for heating are of the easily replaceable type, so that when any do burn out they can be replaced by the man on the job.

The domestics are highly delighted with the working arrangements, and in the course of a few days were working the electrical apparatus freely and confidently. One of the first things found out was that instead of having to get up before 6 a.m. in order to be ready for breakfast time, they do not require to be down till after 7 a.m. This is owing principally to having no fires to clean and lay, hot water always being ready, and the absence of dirt.

The contractors for the whole survey, design, and carrying out of the complete installation were Messrs. Anderson and Munro, Ltd., electrical engineers, Glasgow. It is interesting to note that this most modern electrical installation was carried out by the oldest firm of electrical engineers and contractors in the kingdom.

Anglo-Swiss Commercial Relations.—An article on this subject is contributed to the first number of the *Anglo-Swiss Review* (May 1st) published at Basle. The author is Mr. J. R. Cahill, the British Commercial Attaché at Berne. He gives tabulated statistics relating to trade between Switzerland and the British Empire, discusses where British methods of dealing with the market have fallen short in the past, and refers to the recently established British Chamber of Commerce for Switzerland, and the service which it should be able to render. He states that the effort on the British side to secure Swiss business has been sadly wanting in the past, and urges British firms to explore more minutely the potentialities of the market, and to make organised efforts on settled lines to start or to develop trade. Membership of the new Chamber of Commerce should greatly assist them to that end. Among the other articles in the *Review* is one on "Mutual Interests of British and Swiss Machine Industries," by O. Cattani, and one on "University Matters: the Case for Exchange of Swiss and English Students," by J. H. Smith.

CABLE-FAULT LOCALISATION.*

By EDWARD RAYMOND-BARKER

To the "Correspondence" columns of the ELECTRICAL REVIEW of May 7th, 1920, a writer communicated a decidedly instructive inquiry as to a quick and correct method of localising a certain unusual type of cable fault. Advisedly is the adjective "instructive" here used, for few data are more so than those descriptive of some fresh, puzzling experience; an experience utilised—may-be—by an intelligent observer, to arouse sympathetic interest of, and further inquiry from, some fellow-reader of the ELECTRICAL REVIEW, with ultimate acquisition of corroborative data and—perhaps—assistance.

The correspondent has written over the appropriate pseudonym "Kon Denser," as if, in pursuing elucidation of his problem, he, with true instinct, already scented the track of his cable's own electrostatic inductive capacity.

"Kon Denser's" inquiry has brought to the present writer—across a quarter of a century of time—a salt-laden gust, or two, from stormy seas, with distinct recollection of curious characteristics evinced by a fault (of a hitherto unheard-of species) in cable coiled in a ship's tank—a fault, however, now seen to be not without certain points of resemblance to that which has caused our fellow-reader "Kon Denser" to send out a somewhat urgent S O S.

Almost exactly 25 years ago, during a fairly long voyage from port to port, through—as it happened—heavy seas and generally bad weather, we had to turn over cable and bring about redistribution of cable in the ship's tanks.

One section of india-rubber core cable was 43·684 N.M. in length, and consisted of 23·980 N.M. spliced on to 19·704. This length, at an observed temperature of 58° F., ought to have shown a conductor resistance of just over 463 ohms, and an inductive capacity of a little over 14 mfds.

Yet tests on this piece of cable presented curious, and, at first sight, inconsistent features.

Insulation.—Whether test was applied to top end in tank while bottom end *free*, or *vice versâ*, or into both ends looped, insulation was good, and showed normal dielectric resistance for the whole 43·684 N.M.

Capacity.—(Whether by comparison of deflection throws, or by the Kelvin method.)

Results of tests (1) into top end while bottom end *free*, or (2) *vice versâ*, or (3) with ends looped, always gave the correct total capacity of just over 14 mfds.

Conductor Resistance.—Here was the mystery. Tested by various methods the C R of this piece of cable, instead of being what it ought to have been, namely, about 463 ohms, persistently gave a steady three hundred and fourteen thousand ohms (314,000$^{\omega}$).

All this appeared to point to a broken conductor with ends separated within the rubber covering. Yet with some degree of continuity through, perhaps, a conducting film, on the inner surface of the rubber, sufficient for passage of static charges in the inductive-capacity tests.

How, then, if capacity charges always got past the break, over the film, was the break in the conductor to be localised?

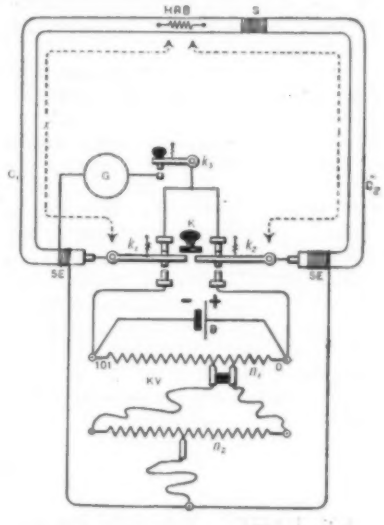
The late Mr. C. N. C. Evers, then acting, on board, as the present writer's senior assistant, made a very good suggestion as to the possibility of obtaining by the use of slides, relative distances from the two ends of the 43·684 N.M. cable by means of charging simultaneously the two ends of the cable from opposite *sign* potentials, from some very low E.M.F.

This happy suggestion, due to Mr. C. N. C. Evers, was successfully effected by the present writer using Kelvin capacity test connections with Kelvin-Varley slides.

Instead of the cable being balanced against a standard condenser, one cable end of the 43·684 N.M. was balanced against the other, the high-resistance film at the break being, in this case, of a resistance sufficiently high to keep separate the two adjacent but opposite *sign* charges.

In this manner, then, two charges were to be adjusted, by means of the Kelvin-Varley slides, to balance each other when blended or mixed, the slide-reading then indicating not only relative charging potentials, but also the relative amounts of the two cable charges in the two portions of the total length of 43·684 N.M. This, of course, is tantamount to giving the relative lengths on either side of the fault. Thus the fault is localised.

The connections as arranged by the present writer are shown in the accompanying diagram :—



C_1 = 23·980 N.M. of I.R. cable.
C_2 = 19·704 " " " "

43·684 " total cable section joined through at splice S, and coiled in ship's cable-tank.

H R B = High-resistance break of conductor inside dielectric.

S E = Cable-sheathing "earth" connection.

B = One Leclanché cell.

G = Sullivan mirror galvanometer ("Marine" pattern).

K V = Kelvin-Varley slide resistances = 100,000$^{\omega}$.

K k_1 k_2 k_3 = Lambert mixing key for Kelvin capacity tests.

K depressed causes k_1 k_2 to connect up C_1 and C_2 respectively to opposite sign battery potentials.

K raised causes k_1 and k_2 to rise and to connect and blend converse electrical cable charges balanced by means of the K V slides till depression of k_3, after the said mixing, gives deflection throw *nil* on G.

[*Note.*—The Lambert mixing key is shown here as it lends itself well, in the various stages of the test, to diagrammatic clearness. See H. R. Kempe's "Handbook of Electrical Testing." Seventh edition, p. 405. The key actually used by the present writer was W. A. Price's excellent (Silvertown) mixing key, as shown in H. D. Wilkinson's "Submarine Cable Laying and Repairing." Latest edition, p. 483.]

Dotted lines x and y show relative position of high-resistance break (H R B) as deduced from test with K V slides, n_1 n_2 = slide reading of 2,559, *i.e.*, 2,559 out of 100 × 100 = 10,000 total subdivisions of the slides

* On May 20th this article was posted to the Editors of the ELECTRICAL REVIEW. On May 23rd the writer received privately from "Kon Denser" interesting data and incidental proof that, at 3 p.m. on April 24th, he was called upon to tackle the fault-localisation, and that, by capacity methods, not only was the fault successfully localised, but by 6 p.m. the repair had been effected, and the plant was again running O K. Owing to academic and theoretical interest attaching to an unusual type of fault, "Kon Denser" wrote to the ELECTRICAL REVIEW the letter which appeared on May 7th. On his own initiative does the present writer add this note to show that, after all, it was "off his own bat" that "Kon Denser" attained success.—E. R.-B.

causing relative charges on each side of the high-resistance interior fault H R B to neutralise each other, so that deflection throw on G when k_3 is depressed becomes *nil*.

The slide-reading 2,559 gives the proportion :—

2,559 : 10,000 :: x : 43·684 N.M. or x = 11·179 N.M.
7,441 : 10,000 :: y : 43·684 N.M. or y = 32·505 N.M.

10,000 43·684 N.M.

Distance of fault from splice = 23·980 N.M. − 11·179
= 12·801 N.M.

This merely approximate value was sufficiently accurate to point to the fault being at the sixth joint in this length of cable, which joint, by section-book, was 12·111 N.M. from splice S.

This cable was then turned over from one tank to another. When the cable was purposely bent at the sixth joint-mark, the electrical control test gave indications of the fault being there. On the cable being cut, the conductor was found to have been broken at the braze of the sixth joint. Although the conductor, together with its lapping of fine copper wire, had been severed, and the two portions of the braze slightly drawn apart, a high-resistance, but nevertheless conducting film (= 314,000 ohms), due to chemical action between the braze and the surrounding india-rubber, had formed on the inner surface of the rubber, just, in fact, as the curious behaviour of the cable when first tested successively for insulation, capacity and conductor resistance, had led one to suspect.

To sum up :—It appears to the present writer that, in certain respects, the foregoing instance is somewhat analogous to the case cited by "Kon Denser."

In the latter instance, one of the copper conductors of a twin cable embedded in glazed troughing run in with pitch and capped with tiles, had developed a fault owing, apparently, to water getting through the pitch and eating away the copper strand. The resulting sulphate of copper at the fault gradually came to constitute a comparatively non-conductive block, this block virtually insulating, one from the other, each side of the severed copper strand.

Except that, in this instance, the insulation of the cable appears to have been affected primarily, from the outside, by water—whereas in the case cited by the present writer, cable insulation remained unimpaired—the two cases seem fairly analogous.

Hence it would be most interesting to know if electrical tests on lines similar to those afore-described—namely, by balancing, in the Kelvin mixing method, the two cable capacities separated by the copper sulphate crystal block—have helped in any way to solve the problems so interestingly described by the ELECTRICAL REVIEW correspondent "Kon Denser." To him, by the kind courtesy of the Editors of the ELECTRICAL REVIEW, the present writer has already been privileged to communicate some suggestions.

Since the above matter was written the writer has heard that "Kon Denser's" two cables are without any metallic sheathing or wire armouring.

This leaves one rather in doubt (1) as to the inductive capacity of the two braided wires laid in glazed troughing run in with pitch, the nature of the bed in which the trough lies being doubtful, and (2) as to whether the inductive capacity conditions—whatever they may be—*are uniform* along the entire length of "Kon Denser's" two braided conductors.

If conditions be not uniform, the difficulty of localising an insulated break is much greater than it would otherwise be.

It might, however, be feasible to act in the following manner: Earth the good cable, and, with one pole of testing cell likewise to earth, measure relative inductive capacities between the faulty line (respectively on each side of the high-resistance break fault) and the good line which has been earthed.

Actual capacities in terms of microfarads would not be necessary. Relative discharge throws, in terms of scale divisions on a mirror galvanometer scale, from the two cable ends would be sufficient so long as exactly similar testing conditions prevailed at both ends of the faulty line.

Relative charge, or discharge, deflection throws—from any really insulated break—would indicate relative cable lengths out of the total length of 100 yards which, according to "Kon Denser," is the length of his twin cables.

Similarly, with the faulty cable earthed at both ends, a charge, or discharge, deflection from the good cable (insulated at the far end) in terms of galvanometer-scale divisions, ought to be equivalent to the sum of the two deflection throws from the two separated sections of the faulty cable, when the good cable was earthed.

"WIRED WIRELESS" TELEGRAPHY AND TELEPHONY.

REFERENCE has from time to time been made in our pages to the experiments that have been carried out by the U.S.A. Signal Corps in connection with multiplex telephony and telegraphy over open-circuit bare wires laid in the earth or under water. A paper on this subject presented to the National Academy of Sciences in April last by Major-Genl. G. O. Squier, chief signal officer, U.S. War Department, was recently abstracted by *Science*, from which the following particulars are taken.

The "key problem" in the procurement of essential Signal Corps supplies in the United States during the war, curiously enough turned out to be the production of the necessary braiding machines for finishing insulated wire. The bare wire itself and the insulating materials could be obtained, but the necessary machinery for braiding the thread was never anything like adequate for the enormous supplies required in the field.

The braiding capacity of the entire United States, at September 1st, 1918, was about 8,000 miles of twisted pair insulated wire per month, while the requirements for the American forces alone at that date were about 40,000 miles a month. The Allied Council decided that beginning March 1st, 1919, the United States should furnish all of this type of wire used by the Allied armies in the field. To supply this amount of insulated wire would have required cargo space for overseas shipment to the amount of 14,000 ship tons a month, but had it been possible to use single conductor bare wire in place of the twisted pair insulated wire, the space required would have been reduced to 2,500 ship tons a month, thus releasing the balance for transportation of other vitally necessary supplies.

The above facts show the necessity of developing, if possible, new methods by which a reduction may be effected in the enormous quantities of expensive and bulky insulated wire, which was so difficult to procure, and which must now be buried in the earth to a depth of 8 or 10 ft. throughout the advance sectors of the front line of a modern army.

The following reasoning led to the carrying out of the experiments to be described :—

1. Since we can already communicate by radio means between one submarine and another submarine both completely submerged, it was considered that connecting two such stations by a submerged copper wire could have no other effect than to facilitate the propagation of the electric waves between the stations.

2. It was considered possible that the behaviour of earth or water under the action of high frequency currents might exhibit greatly different properties from those with which we are familiar at direct or low frequency currents.

3. It was realised that whatever high frequency energy losses might occur in the case of bare wires laid in earth or water, yet the over-all efficiency would be higher than in the case of radio space transmission where the plant efficiency is so very low.

4. It was noted by the writer in September, 1910, that the three-electrode audion could be used as a potentially operated device on open circuits. This arrangement was considered suitable for the reception of the signals over bare wires in earth or water.

The first experiment was a simple one : A bare No. 18 phosphor bronze wire was laid across the Washington Channel of the Potomac river. It was paid out with sufficient slack to lie on the bottom of the river. A standard Signal Corps wireless telephone and telegraph set, SCR 76, was directly connected to each end of the wire, one set serving as a transmitter and the other as a receiver. At the receiving end of the line the bare wire was directly connected to the grid of the receiving set and the usual ground connection left open. A frequency of about 600,000 cycles a second was used, and the line tuned at each end by the usual methods. Excellent telegraphy and telephony were obtained. Care was taken to make this preliminary experiment as simple and basic as possible and precaution taken to ensure that the wire itself

should be bright and clean and entirely free from any grease or other insulating material.

This success immediately led to more thorough consideration of the entire subject. The following experiment was made:—

A strip of wire netting was buried in the snow outside an office in Washington and a wire attached thereto leading to the second story of the building. The upper end of this wire was connected directly to the grid of an electron tube, which was to be used as a potentially operated device. It was necessary for maximum sensitiveness to connect it to the point of maximum potential of the antenna which in the case of a linear oscillator occurs at the open end. By this arrangement, messages were readily received from distant points in the United States.

These two simple experiments demonstrated the possibility of transmitting electromagnetic waves along bare wires submerged in water and the use of an electron tube as a potentially operated device for the reception of signals. The Signal Corps has recently undertaken certain investigations in the phenomena connected with the transmission of high-frequency electromagnetic waves over bare wires in earth and in water. In attacking the problems from various angles, the research staff of the Signal Corps laboratory at Camp Alfred Vail, Little Silver, New Jersey, was directed to carry out experiments on bare wires laid on the surface of moist ground and also buried in earth. The Signal Corps research laboratory at the Bureau of Standards was directed to investigate fundamentally the transmission of electromagnetic waves over bare wires in fresh water. In addition to this, the office of the Chief Signal Officer has carried out from time to time certain experiments of a more or less crucial character which have come up for solution in the prosecution of this work at the other laboratories. The phenomena associated with the transmission of high-frequency waves over bare wires in earth or water are obscure and complex, and the writer has formulated no definite theory at the present time.

The results obtained are as follows:—

1. Telephone and telegraph communication has been established across the Potomac river, below the city of Washington, over a distance of about three-quarters of a mile, by the use of a bare No. 12 phosphor bronze wire laid in the water to connect the stations. The transmitter consisted of an electron tube oscillator which delivered a current of about 270 milliamperes to the line at a frequency of about 600,000 cycles a second. At the receiving end of the line an electron tube and a 6-stage amplifier were used without any ground connection. With this arrangement good tuning was obtained at both ends of the line, and telegraphic and telephonic transmission secured over the bare wires immersed in fresh water.

2. A resonance wave coil has been developed in the form of a long helix wound with a large number of turns on which stationary waves are produced by the incoming wireless signals. An electron tube is used as the detector, the grid being connected to the point of maximum potential on the coil. The wave coil may be used either as a part of the usual antenna system or a part of a line wire, or it may act itself as the antenna for picking up the energy of the signals. In the latter case the coil may be either free at both ends or grounded at one end. Good results have been obtained in either case. It has been also found that the open coil has directional properties and can be used as a goniometer not only for horizontal measurements, but for vertical measurements as well. This form of wireless goniometer has the great advantage that it permits not only of determining the plane where the signals are strongest, but also the direction from which such signals proceed.

Telegraph and telephone communication has been also established between two stations at Camp Alfred Vail, using a bare No. 16 copper wire buried in the earth to a depth of about 8 in. to connect the stations. The distance between the two stations was three-quarters of a mile. Frequencies as high as one million cycles a second were used. Similar communication has been carried on over a bare wire one and three-quarter miles long laid on the surface of moist earth. The current at the transmitting station in these installations was about 100 milliamperes. It has been shown that a bare wire buried in moist earth with the distant end open can be tuned both at the transmitting end and at the receiving end.

In the older art of ocean telegraphy, the elaborateness of line construction has already reached a practical limit. The most promising hope of improving the line construction for ocean cables is believed to be to abandon the present method of design and construction, and to start with the simple case of bare wires in water, using high-frequency currents, and study the necessary changes to produce optimum transmission. The use of a high-frequency "carrier" has the inherent advantage that the distortion phenomena accompanying present methods of long-distance transmission are eliminated, and we are principally concerned with the problem of reducing attenuation. The most suitable voltage may be employed and present multiplex methods may be utilised. The electron tube is available for both the generation and the reception of the waves.

During the last few years an intensive study has been made of the surface conditions of wires necessary to produce the emission of electrons, and to this intensive study, both by universities and industrial research laboratories, is due the high state of efficiency of the present electron tube. Nothing short of a similar study of the surface conditions of wires for preventing the emission of electrons instead of producing them, will finally give us the wire conductor of the future.

The development of types of resonance wave coils, both open at one end and at both ends, for general wireless work offers an interesting field for investigation. This involves the study of the electron tube as a potentially operated device. The application of such coils properly designed for specific purposes may lead to the practical solution of a number of wireless problems such as directional effects, and wave coil antennæ of very small dimensions.

THE ELECTRIFICATION OF HOLLAND.

A NATIONAL SCHEME.

One of Holland's greatest difficulties as an industrial country has been the high cost and consumption of coal in all her industrial undertakings. This it is now proposed to remedy by an extensive scheme of electrification, embracing practically the whole country. According to the *Board of Trade Journal*, a network of H.T. transmission lines has been planned (fig. 8), and it is hoped that in due course Dutch industries shall enjoy the advantages of cheap power in order to be more favourably placed for export purposes against more fortunate competitors. In any case, it is considered that great economies will be effected by concentrating the various electricity supply undertakings into a national scheme which, at the same time, will be useful to develop the smaller manufactories all over the country.

Fig. 1.—Electric Winder.

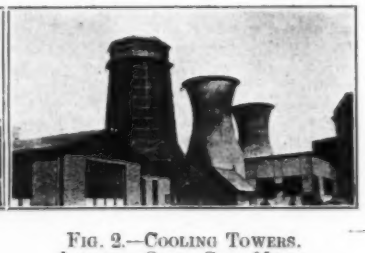


Fig. 2.—Cooling Towers. Limburg State Coal Mines.

The scheme, as at present estimated, is to cost 125,000,000 florins, and it is understood that as Dutch manufacturers are not in a position to tender for all the plant required, a fair proportion of this will be placed abroad. Already orders amounting to over £1,000,000 have been secured in this country.

There are several companies in Holland supplying electrical power, &c., in various localities. Their activities, under the new scheme, will be allied to those of the State—the former being charged with the 10,000-volt, and the latter undertaking the 50,000-volt distribution. Such a scheme will necessitate the surmounting of many difficulties in such a country as Holland, which lacks any assistance from water power.

The following table illustrates the very considerable increase that has taken place in the consumption of electrical power, &c., in Holland since 1913:—

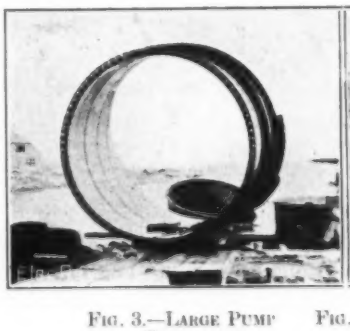


Fig. 3.—Large Pump Casing.

Fig. 4.—Outdoor 3,000-volt Switch at a Farm.

	Max. load on station. KW.	Total consumption per annum. KWH.
1913	45,600 ...	114,000,000
1914	53,600 ...	134,000,000
1915	69,600 ...	173,000,000
1916	88,400 ...	221,000,000
1917	90,000 ...	216,000,000
1918	100,000 ...	240,000,000

To meet present requirements the Government Committee reporting on the question under the present scheme is of opinion that it is necessary to arrange for a total load on the electrical power stations of 4,000,000 KW., giving a total capacity of 1,000,000,000 KW.-hours per annum. Such a supply will mean, with an anticipated population of 10,000,000 inhabitants in the next 30 years, a consumption of 100 KW.-hours per head per annum, as against 35 to 40 at present. This will compare with a present approximate consumption in the United States of America of 176 KW.-hours per head, 140 for Switzerland, 60 for England, 50 for Germany. The estimate does not take into account the electrification of railways and the replacing of all steam traction by electric traction, for which it is provisionally estimated that 250,000 KW. will be necessary, although not more than one-third of this amount will be required for the next 15 years.

The construction of the transmission lines for the whole country may take from 5 to 10 years. For the H.T. network three-phase current, 50 cycles, is to be adopted, the minimum voltage being 50,000. The capacity recommended for the power stations supplying the system is approximately 30,000-75,000 KW. Each station will be equipped with generators developing 15,000 KW. As the first step in the scheme, certain legislation is necessary to empower the Government to take over those electrical supply undertakings which are necessary for incorporation in the scheme. These are:—

1. The power station at Geertruidenberg, with the 50,000-volt lines in the Province of North Brabant belonging to that power station.

2. The recently-built power station of the municipality of Amsterdam.

It is also recommended that the construction of H.T. lines should commence immediately as under:—

1. Roosendaal-Flushing or Middelburg.
2. Helmond or Uden—South Limburg.
3. Geertruidenberg-Rotterdam-The Hague-Amsterdam, with a branch line to Utrecht.
4. Uden-Nymegen-Arnhem-Zwolle.

The cost of the above is estimated at 35,000,000 to 40,000,000 florins.

As far as is known at present, a special Administration is to be created for this service. Several alternatives have been under consideration, particularly a proposal under which the State would hold a large block of shares in a company registered for the purpose. Preference has been given to a State enterprise under which the supply of electricity is to be a direct Governmental service endowed with a large measure of freedom. Working agreements will be made as to the supply of electricity and the sharing of profits with municipal and other companies administering the scheme.

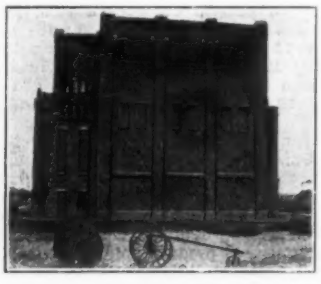


FIG. 5.—50,000-VOLT SUB-STATION.

FIG. 6.—50,000-VOLT LINE CROSSING RAILWAY.

FIG. 7.—LIMBURG STATE COAL MINE.

A committee, formed by the Society of Directors of Electricity Supply Undertakings in Holland, has been investigating this proposal for some time past, and is to publish a report in eleven parts, four of which have been issued up to the time of writing. The first deals with the question of determining the positions of the H.T. transformer stations. The committee has calculated that for loads of 7 to 20 KW. per sq. km., the feeding of the 10,000-volt cables with 50,000 as well as with 100,000 volts will be secured in the most economical way if the transformer stations are 20 to 30 km. apart.

In the second, the feeding of the high-tension transformer stations (determining the area of wires, &c.) is reported on. The average distance of the feeding points of the 10,000-volt distribution cables having been fixed, there remains the question of voltage and the cross-section of the H.T. lines, which have to feed the 50 transformer stations. The calculations are based upon the supposition that the transformer stations are situated at regular distances of 25 km., and that they are all equally loaded. The results of these calculations are shown in graphs, added to the report.

These graphs also show that for large but sparsely populated districts a very high voltage is most economical, whereas for heavily-loaded industrial centres a lower voltage is to be preferred. It is furthermore evident from this report that the concentration of the generation of electricity has its limits, and it will be preferable, above a certain amount of power (*e.g.*, 30,000 to 50,000 KW.) to erect more power stations instead of making a heavier H.T. distribution system.

So the second part of the report gives an idea not only of the voltages and cross-sections of wire, but to a certain extent also of the number of power stations wanted. The third report deals with the scheme from the point of view of national defence.

In the last, the transmission of electrical energy from the mining district is outlined. It is stated that in addition to feeding the transformer stations the H.T. lines should also be capable of performing other functions. They should, for example, be able to transmit electricity from places where, for some reason or other, the costs of generating electricity are very low. The question of feeding a part of the network from the South Limburg mining district is then specifically examined.

For the accompanying views of electrical installations in Holland we are indebted to Mr. C. H. Wordingham; they were taken during the I.E.E. tour in Holland in September last, of which an account was given in our issue of October 24th, 1919.

FIG. 8.—PROPOSED H.T. NETWORK IN HOLLAND.

Strike at Sheffield.—Through a strike of the National Amalgamated Union of Enginemen and Firemen against the three-shift system, a number of big works in Sheffield were closed down almost completely on Monday. Messrs Hadfields and other works together had 20,000 employés thrown idle.

ALL-BRITISH SWITCHGEAR.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.

The now well-known business of Messrs. Reyrolle was opened in 1901 with the manufacture of ordinary designs of open-type switchgear and accessories, including motor starters, knife switches, tubular fuses, wall plugs, &c. At that time it supplied a much-felt want for electrical apparatus of a more substantial design and sounder workmanship than was usually procurable, and as the late Mr. Reyrolle had in his earlier works in London already established a reputation for these qualities, the business was soon thriving.

Two or three years later, other experts were added to the staff, and attention was given to the production of special forms of switchgear and protective systems which were found to be necessary as more experience was gained on larger power supply systems and the uses of higher electrical pressures. Certain novel principles of design were introduced, including the complete enclosure and immersion of all conductors, for safety to life and plant. New methods of locating and isolating faults were developed and successfully applied to the power station and sub-station equipment of the enterprising local power companies, which were thus assisted in maintaining continuity of supply to their consumers.

For many years these local users absorbed practically the whole of the output of this special design from this company's works, and in the meantime much valuable information was obtained of working conditions, progress was made, and designs were strengthened as required to withstand the increased stresses which were met with as the generating plant of the power companies grew in dimensions. Thus a very sound foundation of experience was quietly laid, prior to putting the new principles to the test of the market outside this district. This was first successfully attempted on a scale large enough to be of importance, in reply to a call for tenders issued by the Stepney Corporation. Notwithstanding the substantial nature of the Reyrolle apparatus, it was found possible to offer it in the open market at a competitive price.

Since that time a demand has consistently grown from the largest power supply undertakings in this country, including the Corporations of Sheffield and Glasgow. The designs have become firmly established in British practice, and one frequently hears that whatever may be thought of the general electrical engineering developments of foreign countries, at least the switchgear standards set by this company without doubt testify to the superiority of British origin.

The orders at present in hand include the largest and most important contracts ever placed for switchgear for use in Great Britain. For instance, one is for the main 20,000-volt controlling apparatus at Dalmarnock power station, one of the first super-power stations of this new electrical era. Another is for similar apparatus for Nechells, the future great generating station of the Birmingham Corporation. The fact that both these important contracts were placed at higher prices than those of competitors bears witness to the merits of the designs and the quality of the workmanship, but these of themselves might not be sufficient to satisfy a large public body if they were not also backed up by economies effected in other ways, such as reduced costs of building accommodation, every-day operation, and general maintenance.

The restricted size of the works, and the difficulties of manufacture, have, to a great extent, limited the scope of the supplies to the home market, and even there many new fields are untapped, but some time and material has been reserved to keep in touch with the fringe of the Colonial and foreign markets; for instance, switch panels for many years have been supplied to the Rand, South Africa, and to the Durban Corporation, and some important 10,000-volt sub-station apparatus to Capetown Corporation. Other work includes sub-station switchgear for railway electrification in South America; power and sub-station switchgear for the Corporations of Shanghai and Madras; and track feed and signal pillars and 20,000-volt sub-station switchgear for the Melbourne railways. As an example of the influence of this British practice on the Continent, much interest is evinced in Holland, whose engineers for the Government interlinking scheme (described elsewhere in this issue) have visited this country and have ordered armour-clad switchgear.

Messrs. Reyrolle & Co. have taken full advantage of their opportunities in all but quantity and speed of production; this exception is due only to want of material, room, and plant. As to material, improvements have been made in the organisation to ensure supplies as and when required by the shops; the handicap of limited room and plant has created the need for increased capital. New shops have recently been opened, of which we give a view, and with more adequate facilities for production, a more fruitful effort to supply the increasing demands will become possible.

Messrs. A. Reyrolle & Co.'s New Shops.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Composition v. Porcelain Insulators.

There has recently come into my hands a brochure, published by Thos. de La Rue, upon a composition insulator named "Telenduron," in which this material is compared with porcelain, to the disparagement of the latter.

It is granted, of course, that almost any composition material is less brittle than porcelain, though good English porcelain is much tougher and more resistant to breakage than many people imagine, more especially when the porcelain is fairly thick, as used in transmission work.

In this brochure, however, porcelain is condemned as depending upon its glaze for its insulation, and it is stated that upon the failure of the glaze by hair cracks the porcelain absorbs moisture (*sic*). This may be true of rubbish, mostly foreign, styled porcelain, but it is surprising that it should still be necessary to inform some people that proper English porcelain as made by reputable firms for the purposes mentioned (all of which porcelain is made by the wet process) does not depend upon the glaze for insulation, the porcelain being vitreous and homogeneous, and the glaze being added merely for finish and possibly colour.

"Telenduron" is set up as being non-hygroscopic and of marked superiority to porcelain, but this is not corroborated by the tests which they publish, made by the National Physical Laboratory, as shown in the following comparison:—

Tests on Post Office small insulator.	Telenduron.	Porcelain.
Flash-over voltage, dry....	40 K.V.	40 K.V.
Puncture voltage... ...	25 K.V.*	Immeasurably small.
Absorption...	·1 to ·3%	Certainly below ·01%

* Note.—It is important that the puncture test of any insulator should be greater than the flash-over dry. This is so with the porcelain insulator, but as the above tests show, is not so with "Telenduron."

Whatever advantage this material may have in respect of lesser liability to breakage is obtained, therefore, at the ex-

pense of its electrical characteristics. This, no doubt, is justified in many cases, but I note that in their covering letter they make reference to the use of this material for high-voltage transmission work; in this connection, electrical considerations are the primary considerations, and all others are secondary.

Then there is the question of durability, having regard to the deleterious atmospheric conditions which obtain in some manufacturing districts in which insulators have to work. No tests are given here, but in this respect a composite material (which often incorporates vegetable and animal substances) can scarcely be expected to compare with porcelain, which is made from rocks of the earth itself.

Twiss Engineering & Transmission, Ltd.
G. W. V. TWISS, M.I.E.E.,
Managing Director.

London, E.C., *May 26th*, 1920.

Mutual Discussion.

My attention has been drawn to the enclosed report published in your last issue with regard to the National Alliance of Employers and Employed. In the section which I have underlined you will note it is stated: "The National Alliance justly claims to be the only organisation which can provide the machinery for a round-table conference of employers and employed."

I feel sure this has been inserted in error, and should therefore be greatly obliged if you would point out in your next issue that the Industrial League and Council, which is engaged in this work, has been in existence since 1915, and is an organisation well known to the public, its presidents being the Rt. Hon. G. H. Roberts, M.P. (ex-Minister of Food), and the Rt. Hon. J. H. Whitley, M.P. (Deputy Speaker of the House of Commons). The primary work on which the Industrial League is engaged is to encourage the establishing of Whitley Councils, which are the effective channels of round-table conferences of employers and employed.

John Ames,
General Secretary,
Industrial League and Council.

London, S.W.1.
May 29th, 1920.

[Why does our correspondent misquote us? The word "justly" does not appear in the ELECTRICAL REVIEW ("Mutual Discussion," May 21st, p. 653). The Alliance is entitled to make any *claim* that it likes. *We* do not feel called upon to decide which is the more suitable organisation for the purpose indicated; it was for that reason that we omitted the word "justly." All Alliances, Councils, or Leagues that are working to encourage more harmonious relations between employers and employed have our support and cordial good wishes. But why this jarring note of rivalry, evoking the rejoinder "Physician Heal Thyself"? Competition in good works is good; co-operation is better; complete union might be *best*—we do not know.—EDS. ELEC. REV.]

The Policy of the E.P.E.A.

My attention has been drawn to the letter signed by our Mr. W. E. Weston, and I would like to point out that in the opinion of myself and my committee this letter is very ill-advised, and is only the personal opinion of our Mr. W. E. Weston, and in no way represents the policy of my committee.

W. J. Webb,
London District Secretary,
Electrical Trades Union.

London, E.C., *June 1st*, 1920.

"Situations Vacant."

The above heading I have no doubt will be very familiar to most readers of your journal, for it has as long as I remember been famous as the heading of a column eagerly watched and criticised by those in the electrical industry. The criticism is, of course, of a varied nature, and I have known readers who have been highly annoyed and somewhat amused at the scandalously low salaries offered by employers (usually represented by a box number). There have been many letters in your "Correspondence" column pointing out the unfairness to the employé of the Box No. system, and while this is not the point I am getting at, I should like to point out that the employé is as necessary to the State as the employer; each depends upon the other. Therefore it should not be made so difficult for the employé to get comfortably through this life as compared with the employer (generally speaking). For instance, an employé wishes to better himself, or even to change his job; he answers an advertisement, but has to send his history to a Box No. He is expected to do this, and is not allowed to know to whom he has written, and in some cases, if he only knew it, he has applied to his present employer. Then again, after taking this trouble, he frequently hears nothing, and simply wonders where his application landed. I consider that no just mind can consider this matter thoroughly without coming to one conclusion. I will come to my point and suggestion. This point I do not think has been quite so much considered. In some cases an applicant will receive an acknowledgment and an interview; he leaves the employer's office after being treated very nicely, and often given many details of the new duties connected with the post, with a promise that he will in due course hear the result of the interview, and he feels confident that he has given satisfaction, and will get the post. He, however, waits and waits, and hears nothing, the employer not keeping his promise. The applicant is not to know one way or the other. I certainly think an applicant should be informed whether successful or not; I suppose I dare not suggest that he should be given a reason why not successful, although the fact that the employé is never given any satisfaction is responsible for a very serious suspicion which exists to-day amongst the employed that their present employers do not give satisfactory references, or adopt some means to prevent men from leaving their present jobs. If there are no grounds for this suspicion, why cannot some action be taken to remove it? There is no doubt that the suspicion exists. Again, in certain cases employers, after receiving applications, select certain ones and send an official form of application, with details of the vacant post. The employé, to suit the employer, makes a fresh application with further information, and returns it, to hear nothing further one way or the other. I consider these tactics totally wrong and unbusinesslike, and my suggestion is as follows: That these matters should be brought before the Joint Industrial Councils with a view to an agreement being come to, that all applications sent to Box Nos. should be acknowledged by the firm concerned, and the applicant informed whether successful or not, within a reasonable time. I believe very much in the D.J.I.C. idea, and if such matters as these were properly dealt with it would certainly promote the purpose of Industrial Councils, and in this particular case would soon do away with the Box No. principle. In conclusion, I give two extracts from the Whitley scheme:—

1. To make and consider suggestions for securing a permanent improvement in the relations between employers and workmen.

2. To recommend means for securing that industrial conditions affecting the relations between employers and workmen shall be systematically reviewed by those concerned, with a view to improving conditions in the future.

J. C.

[We refer to this matter in our leading columns.—EDS. ELEC. REV.]

The Efficiency of Domestic Electric Heating.

I was extremely pleased to see Mr. G. W. Stubbings's article under the above heading, because, far more important than that a truer aspect of the question should have been set forth than that placed before the public by the gas companies, is the understanding of the subject by all those who deal in the apparatus, and this can only be obtained by thorough discussion and an earnest attempt on the part of your readers to understand the meaning of the figures, and not just to skim them over and take them for granted.

I am sure that Mr. Stubbings will forgive me if I say that although he refers to a series of articles, he practically only deals with one (the first); for the second article corrected the efficiency of the gas oven from 13.6 per cent. to 7.4 per cent., while the third pointed out that the taking of 4 cwt. of coke as the net amount of coke available for sale after treating 1 ton of coal was due to the gas companies' error, and should be 8 cwt.

If Mr. Stubbings had devoted the same earnest attention to the second article that he did to the first he would have seen that this is a much fairer method of comparing the two systems, as it allows for gas and electricity for lighting purposes, and, of course, the use of percentages in this connection is impossible, as there is no standard from which to calculate the efficiency of either system.

If articles two and three are considered together it will be apparent that electricity produced at an efficiency of 20 per cent. will do, with coal of a thermal value of 16.4, what gas requires coal of a thermal value of 34.8 to do, and this figure allows the total potential value of the coke and tar to be deducted. The actual value of the coal used by the gas companies would be 58.24, and the gross value of the coke and tar products 22.624.

When I stated that I had a doubt of the possibility of the whole of the coke being utilised, I thought I made it clear that I was not questioning the 60 per cent. efficiency whether the coke was used for domestic or industrial heating. The point is that industry at present absorbs practically all the coke it can, while if gas engines are to be substituted for electric motors and gas lighting for electric lighting a correspondingly larger make of gas will be made with its con-

sequent increased supply of coke, and it is this quantity of whose use I was dubious. If in addition the report of Lord Haldane's Committee and Sir Dugald Clerk's "James Forrest" lecture are studied side by side the matter stands out even more clearly. Lord Haldane's Committee contemplated the substitution of electricity for the stationary engines of this country, and arrived at certain figures for the amount of electricity required and the amount of coal necessary to give that amount. Sir Dugald Clerk takes the figure for the H.P. required, and says that a certain amount of gas would do the work, which could be produced from a certain amount of coal. Ignoring the fact that his figure for the efficiency of production is both wrong and misleading, it will be seen that the substitution of gas engines for stationary steam engines will immediately do away with the largest market for coke; so the comparison should really be made between 16.4 for electricity and 58.24 for gas.

In conclusion, I must say that the reason the 20 per cent. efficiency of production for electricity was taken was that both the B.C.G.A.'s advertisements and Sir Dugald Clerk's lectures selected this figure, and endeavoured to show that even then gas was more efficient, probably with the idea at the back of their minds that if gas is better than electricity when it can be produced at a 20 per cent. efficiency, how much more so must it be at the present time?

B. S. Klemens.

London, S.E.
May 31st, 1920.

BUSINESS NOTES.

Dr. Arnold's New Steel.—According to the *Times*, Dr. J. O. Arnold, who was formerly Professor of Metallurgy in the University of Sheffield, has sold his production rights in the new high-speed steel invented by him to Mr. J. D. Moffat, one of the directors of Sir Thomas Salter Pyne & Co., and the new steel is to be made in Sheffield.

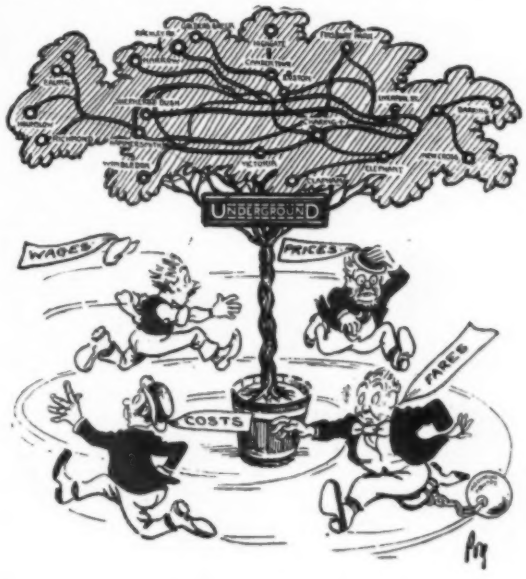
A T.E.T. Dinner.—On Thursday last week the first annual dinner of the Twiss Engineering and Electric Transmission, Ltd., was held at the Criterion. The chairman, Mr. Oscar Andersen, presided, and was supported by Mr. G. V. Twiss, managing director, Mr. S. G. Leech, Mr. Rex Andersen, and other members of the firm. Proposing "The Company," Mr. J. Davie congratulated the directors on having laid a sound foundation for their business, and referred to the unfair incidence of the excess profits duty as between old firms and new ones. In responding, Mr. Twiss agreed that legislation which tended to retard the progress of young concerns was contrary to the interests of the country as a whole. Over a year ago he saw that the necessity of cheap power, involving the centralisation of generating plant, would lead to the erection of cross-country overhead mains, and the company, which would be known as the "T.E.T.," was formed for that purpose; it was now carrying out the biggest scheme of the kind in this country, in the North Wales district, as well as many other transmission schemes both at home and abroad, a very creditable result for one year's working, and that not a favourable year for industrial enterprise. They had started at the psychological instant, and their prospects were so good that Messrs. J. B. Saunders & Co. and Messrs. Laing, Wharton & Co. had joined hands with them. They had laid the foundations, and were now ready, with a well-organised staff, to erect upon them a worthy superstructure; they were doing work which would help to rehabilitate the country and improve social conditions. Mr. H. P. Allison, works manager, proposed "The Guests," for whom Mr. C. O'Malley responded, describing Mr. Twiss as himself a "live wire," who inspired those around him with his own enthusiasm for work. Proposing "The Personnel," Mr. Twiss said the success of the company was largely due to the co-operation and *esprit de corps* of the personnel, from the chairman downwards. The company was employing its full share of ex-service men, and Mr. R. C. Andersen had gained the Military Cross. Their duty was not first to make profits but rather to render service to the country, and in return for such service to receive profits whereby they would be able to continue that service in an ever-increasing manner; the motto of the company would be "Service First." They intended to raise abroad the standing of this country in the transmission of power. After Mr. Davie, at the request of Mr. Twiss, had described the profound impression of British predominance which he had gained during his recent travels on the Continent, Mr. S. G. Leech responded, expressing full confidence in the future of the company and in its founder—provided that the latter did not work himself to death. After the health of "The Chairman" had been duly honoured and acknowledged, the very successful and enjoyable function came to a close at a late hour.

Siemens Lamps and Supplies.—Messrs. Siemens Bros. and Co., Ltd., inform us that they are taking over the lamp and supplies department of Messrs. Siemens Bros. Dynamo Works, Ltd. Contemporaneously with this change, the company is making provision for a largely increased output in metal filament lamps, and it is announced that henceforth these lamps will be sold by the company under the distinctive trade name of "Xcel." This trade name will apply to all types of metal filament lamps manufactured by the company, which include the following:—Standard vacuum lamps, half-watt lamps, automobile and battery lamps (vacuum and gas-filled), helical filament traction lamps. As from June 1st, 1920, Messrs. Siemens Bros. & Co., Ltd., will conduct the business in lamps and supplies from the same addresses in London and the provinces as hitherto, where, in addition to fittings and lighting supplies, attention will be given to inquiries regarding the whole of the material manufactured by the company at its Woolwich Works, such as wires, cables, Stannos wires, telephone and telegraph apparatus, fluid and dry cells, flashlight and torch batteries, &c. The company's showrooms at 38-39, Upper Thames Street, London, E.C., have been redecorated and refitted, and all *bonâ fide* trade buyers are invited to call. We are asked further to remind the trade that the advice of the Illuminating Engineering Department of the company is at the disposal of contractors to assist them in the development of any lighting schemes which they may have in hand.

Power Station Firemen.—Firemen employed in the Liverpool, Birkenhead and Wallasey power stations, are claiming advances through their Trade Union, the National Amalgamated Union of Enginemen and Firemen. Strike notices had been issued to the Birkenhead Corporation, but have been suspended, on a meeting being promised.

The Development of Derby.—The Derby Borough Development Committee, having come to the conclusion that there is nothing so effective as publicity, is arranging with Mr. E. J. Burrows, of Cheltenham, for the issue of a handbook advertising the town at a cost not exceeding £50. The Committee is also contributing £5 towards the cost of an advertisement of Derby and its electricity undertaking in the Electrical Review.

Round and Round.—We reproduce herewith a very telling cartoon issued by the London Underground Electric Railways illustrating the dangerous and frantic chase that is taking place round and round the vicious circle. The educational effect of such posters upon the public mind should be considerable; the



principal object, of course, is to show the railway and tramway passenger how handicapped are the authorities by the chain and deadweight of "maximum powers" restricting fares and preventing them from catching up either costs, wages, or prices.

The following verses accompany the picture:—

Round and Round the Underground Tree.

Here we go round the Underground Tree,
I chase you and you chase me,
Round and round—and so you see,
Nobody gets any further.

Round and round and round we tear,
Cost and Price and Wage and Fare,
With never a chance of "getting there"—
And other folks all cry "Murther!"

Round and round we race, in case
Someone behind should force the pace:
Oh, what an endless, senseless chase:
Oh, what a helter-skelter!

Round and round and roundabout,
Starting again where we first set out;
One of these days we'll stop, no doubt,
Under the Tree for shelter.

J. H. R.

Social.—The termination of a popular series of social evenings held by Pope's Social Club throughout the winter was marked by a successful Whist Drive and Fancy Dress Ball held on May 19th, at which Mr. Stanley Carman, works manager, Pope's Electric Lamp Co., Ltd., was present. There were many striking costumes to be seen among those worn by the 600 members and friends who attended, one of the prize winners being Miss Nunny, who represented an up-to-date "Pope" electric lamp. At the close of the proceedings Mr. E. A. Marx (sales manager) distributed the prizes.

London Coal Prices.—In a written reply to Captain Bowyer. Mr. Bridgeman states that the present maximum retail price of best Derby coal in Central London is 57s. 2d. per ton, as compared with 27s. per ton in 1913. He gives the following analysis of these prices :—

	1913.	1920.
	s. d.	s. d.
Pit price	13 0	33 5
Railway rate	6 4	8 2
Wagon hire	1 0	1 6
Factorage	—	0 4
Distribution charges :—		
Wages, loaders, and carmen	1 10	4 9
Other cartage charges, including sacks	1 1¾	3 7
Loss on smalls	0 4	0 7
Establishment charges, including siding rent ...	2 5½	3 4
Management and interest	—	0 3
Profit...	0 10¾	1 3
	27 0	57 2

—*The Times.*

A Swedish Company.—The directors of the A. B. Luth and Rosen, of Stockholm, reporting on the year 1919, state that a considerable set-back took place in the electrical industry as compared with the favourable situation which prevailed in 1918. The reaction specially affected the company, as large stocks of raw materials were purchased on account of the great influx of orders in 1918. In the accounts for 1918 these stocks were entered at the prices of purchase, which also corresponded with the market prices which existed at the beginning of 1919. The great and rapid fall in prices during 1919, however, rendered it necessary for the stocks to be written down considerably. A circumstance which contributed towards this loss was that the company, as in the case of other Swedish electrical firms, could not help participating in the purchases of copper made through the Government's Industrial Commission. The sudden legislation concerning the prohibition of iron-zinc conductors for electrical purposes also brought about a loss of 500,000 kr. Moreover, the losses were contributed towards partly by export difficulties and partly by the decline in the home demand in the latter half of the year; the removal of mechanical manufactures to the Eskilstuna branch, so as to provide greater space for electrical production at the head works in Stockholm, also affected the results, as also did the lack of success with the heating element according to the Cardellska patents, and with a new type of motor-plough. In addition, the manufacture of electrical machinery at Stockholm proceeded with less favourable results, owing to labour conditions and the difficulties in the question of materials. The prospects at present (May), however, seemed to be brighter. All the shops were well supplied with orders, prices were steadily advancing, and the deliveries of materials were more certain, so that it was no longer necessary to keep large stocks. During the year the company were successful in forming some new export connections, and the directors hoped that this part of the business would be carried on satisfactorily, especially if exchange conditions became regular. The accounts show a loss of 5,390,000 kr. for 1919, as compared with net profits of 2,960,000 kr. in the previous year, on a share capital of 16,650,000 kr. It is now proposed to reconstruct the company by the formation of a new company, under which the loss will be written off, and one new share be offered for two old shares, and cumulative preference shares for 4,000,000 kr. are to be issued.

Dissolutions and Liquidations.—BRITISH ELECTRICAL ACCESSORIES, LTD., Fawcett Row, Bradford. List of creditors in this voluntary liquidation :—

Albion Electric Stores	£234	Bankers	£2,215
Accumulators, Ltd.	19	Lund, Miss	355
Benjamin Electric, Ltd. ..	109	Lund, Percy, P. Lund, Humphries	224
Brearley, H.	37	Liverpool Electric Cable Co. ..	30
British Westinghouse Elec. Co.	33	Leach, S. G., & Co., Ltd. ..	24
Baxendale & Co., Ltd.	54	Pirelli, Ltd.	63
Brocklehurst, W. H.	15	Paterson & Service	12
British Insu. & Helsby Cables	11	Rushworth, J. W...	523
Crowther & Osborn, Ltd. ..	144	Rhodes, J. S.	296
Cable Accessories Co., Ltd. ..	127	Rylands Glass & Eng. Co., Ltd.	34
Cambridge & Paul Inst. Co., Ltd.	52	Reyrolle, A., & Co.	21
Crompton & Co., Ltd.	26	Stephenson, H. & J.	165
Connolly Bros., Ltd.	37	Sanders, W., & Co.	107
Driver, Drennan & Cooper, Ltd.	1,178	Sterling Tel. and Electric Co...	73
Battery D.P. Co., Ltd.	156	Star Electrical Co.	69
English Electric Supplies, Ltd.	13	Sperryn & Co.	36
Falk, Stadelmann & Co. ..	228	Sun Electrical Co.	14
Forward Electric Co., Ltd. ..	39	Taylor, F. W.	454
Gillespie, R. P.	33	Tividale Enamel Co.	28
Hodgson, Mrs.	113	Taylor, W., & Co...	16
Hurst Electrical Plant, Ltd. ..	75	Underwood, Ltd.	105
Judge, W. A.	150	Wilson, W. D.	1,048
Jarrett, Pyrah & Armitage ..	53		

SIGNAL ELECTRIC CO., LTD., Norfolk House, Laurence Pountney Hill, Cannon Street, London, E.C.—A meeting of the creditors of the above was held recently at the Cannon Street Hotel, when it was reported that the shareholders had passed the usual resolution in favour of voluntary liquidation, and had appointed Mr. G. L. Wynn to act as liquidator. A statement was presented showing the position as at May 5th last, and this disclosed unsecured liabilities of £3,152. The indebtedness to the trade was £2,380, while the directors were shown as creditors for fees amounting to £637, and the balance of £134 was due in respect of interest on the preference shares. The assets were estimated to realise £3,937, and as regarded the unsecured creditors a surplus was shown. The assets consisted of cash in hand, £4 18s. 8d.; deposits, £10; furniture, £32; plant at Walthamstow, £44 13s.; patents, trade marks, and secret processes, £2,388; preliminary expenses, £200; and stock at factory, at cost, £1,262. The issued share capital of the company was £5,160, and as regarded the contributories there was a deficiency of £4,375. The company was registered on May 31st, 1919, with a nominal capital of £12,500, divided into 10,000 preference shares of £1 each, bearing interest at the rate of 7 per cent. per annum, and 5,000 ordinary shares of 10s. each. The company had issued 3,402 preference shares for cash, but there were unpaid calls of £125, leaving the net amount received by the company at the sum of £3,277. The company had also issued 3,766 ordinary shares, and the total issued capital was, therefore, £5,160. The company had worked at a factory in Walthamstow, and there was some doubt whether the lease of the premises had been secured. The lease had about 14 years to run, at a rental of £470 per annum, and a portion of the premises was sublet at £300 yearly. The chief director of the company was Mr. C. St. John, who transferred the patents, &c., to the company. It was impossible to say what their present value was. A portion of the stock had not been made up, and might have to be completed by the liquidator. It was also stated that there were contracts still running, and it might be that the liabilities would be increased. The opinion was expressed that the creditors should be represented in the liquidation of the company, and it was decided that an application should be made to the Court for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., as liquidator of the company, while a committee of three of the principal creditors was also nominated. The following are creditors :—

Fish & Ludlow, Ltd.	£601	British Insulated and Helsby Cables, Ltd.	£68
Dangerfield, W. & J.	395	Brownrigg, H. K.	45
Abbey Industries, Ltd.	218	Gilson, D., & Co.	39
Cartland, James, & Sons, Ltd..	168	Baker, W. E.	24
Phillips, Ephraim	168	Norman, L...	22
Drycells, Ltd.	113	Druitt, H.	21
Lovelace, R. E. H.	112	Bailey, S. A...	20
Walthamstow Urban District Council (rates)	99	Flint, C. D.	17
Concordia Elec. Wire Co., Ltd.	81	Lea Bridge Gas Co.	14
Matthey, Johnson, & Co., Ltd.	79	St. John, C.	12

LITTLE WONDER BATTERY CO., LTD.—Winding up voluntarily. Liquidator, Mr. R. G. Pye, 26, Budge Row, E.C. Meeting of creditors, June 8th.

SIEBE, GORMAN & CO., LTD.—Particulars of claims must be sent to the liquidator, Mr. R. B. Petre, 11, Ironmonger Lane, E.C., by June 30th.

ROTASPHERE CO., LTD.—Claims must be sent to the liquidator, Mr. A. S. Jopp, 82, Belvedere Road, S.E., by June 22nd.

ERNEST KING & CO., electricians, engineers and contractors, 97, Bridge Street, Walsall.—Messrs. S. Birch, P. H. Tomkins and E. King have dissolved partnership. Messrs. S. Birch and P. H. Tomkins will attend to debts.

JENNER, CHITHAM & CO., electrical engineers, 11, Red Lion Square, W.C.1.—Mr. H. Jenner and Mr. R. M. Chitham have dissolved partnership. Debts will be attended to by Mr. H. Jenner, who will continue the business at the same address under the style of H. Jenner & Co.

British Trade-Mark Applications.—Appended is a summary of the recent applications for British trade-marks in respect of goods associated with the electrical trades and industries :—

Sollac. No. 400,442. Class 1. Electrolytes, being chemical substances.—Haslam & Stretton, Ltd., 11, Windsor Place, Cardiff. February 5th, 1920.

Quixpark, the Best of Fellows (lettering combined with name and address of firm and design). No. 396,037. Class 6. Magnetos. —Follows Magneto Co., Ltd, Park Royal, Willesden, N.W. October 23rd, 1919.

E.A.C. (monogram design). No. 401,343. Class 6. Electrical machinery.—Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London, S.W., 8. March 1st, 1920.

Elephant on Scooter (design). No. 394,361. Class 13. Electric cut-outs and terminals, electric switches, electric fittings, &c.—Leonard E. Hough, 246, High Street, Lewisham, S.E. August 19th, 1919.

Konled. No. 400,513. Class 13. Electric light and cable fittings.—Faulkner & Co., 5, Market Street, Manchester. February 7th, 1920.

A.E.G. (letters combined with design). No. 359,820. Class 13. Electrical goods of metal.—Allgemeine Elektricitäts Gesellschaft, 2-4, Friedrich Karl Ufer, Berlin, N.W., 10. March 23rd, 1914. (The registration of this trade-mark has apparently been held up during the war, having only just been passed.)

Rajah. No. 401,790. Class 15, also No. 401,791. Class 16. Fittings of glass and porcelain for use in electric lighting, &c.—Herbert & James Stevenson, Ltd., 16, Water Lane, Great Tower Street, London, E.C. March 12th, 1920.

Boreas. No. 398,548. Class 18. Electric and pneumatic bells (as systems in buildings, &c.).—Lacy-Hulbert & Co., Ltd., 91, Victoria Street, London, S.W. December 18th, 1919.

Electrical Exhibition in Holland.—The British Vice-Consul at Leeuwarden, Holland, reports that an exhibition of electrical products will be held by the municipality of that town from August 14th to September 15th, 1920. The Vice-Consul, who is chairman of the Executive Committee, suggests that United Kingdom firms should unite to make up a British Section for which it is possible to allocate a space in a favourable position. A translation of the official regulations has been prepared, and is available to callers at the D.O.T. in London, in Room 48 (Mr. Cresswell).

Catalogues Wanted.—The Electrical Engineering and Maintenance Co., 87, Main Street, Portrush, desire to receive catalogues and other publicity matter.

Lead.—In their report, dated May 29th, Messrs. G. Cawson & Co. say :—

The general consumptive trade still remains rather stagnant. Electrical works, however, continue busy, and are taking good quantities of lead, and appear likely to do so for some considerable time. This demand keeps the market firmer than it otherwise would be.

Supplies continue to come in rather freely, so that there need be no alarm on the part of consumers as to any shortage. With general consumptive demand at about 50 per cent. below the pre-war normal, we cannot see how any shortage in supplies is likely to arise.

The outlook points to a steady market, and should speculators again begin operations, as other metals appear to be reviving, some fresh advance in price is not unlikely.

Messrs. James Forster & Co., reporting under the same date, say :—

The metal market continues under the depressing influence of outside markets and finance, supply and demand having very little to do with the course of values. Consumers generally have been buying with hesitation and only for near delivery, but towards the week-end there has been much more disposition shown to negotiate, and inquiries have been received from different parts of the country which have resulted in business at considerably above the market rates.

The difficulty in obtaining suitable brands is again in evidence, but this has been relieved somewhat by the discharge of steamers this week from Australia, after lying in the docks in one case for over two months and in others for weeks. The shipments from Australia for April are advised at 2,300 tons, against arrivals here in April from this source of 5,750 tons, so that June will be a short month for Australian brands.

Italian Company Notes.—There has been formed at Milan the Consorzio per l'Alienazione degli Impan e Materiali Elettrici e Telefonici Residuati della Guerra with a capital of 5,000,000 lire, of which 1,570,000 lire are paid up, for the liquidation of war plant.

With a capital of 6,000,000 lire the Società Anonima Elettrica Ghise e Accini has been established at Genoa for the output of electric current for the production and trade in malleable iron and special steel and other industrial purposes.

The Società Anonima Elettricità Alta Italia, of Turin, has decided to increase its capital from 30,000,000 to 48,000,000 lire, a portion being allotted to the Società S.I.P. for its Biellese distribution network.

Other companies increasing their capitals are :—The Società Idroelettrica Monviso, at Verzuolo, from 5,000,000 to 20,000,000 lire ; the Società Italiana per l'Utilizzazione delle Forze Idrauliche delle Veneto, at Venezio, from 21,000,000 to 26,250,000 lire ; the Società Elettrica Bresciana, at Brescia, from 36,000,000 lire to a sum unnamed ; the Società Emiliana di Esercizizi Elettrici, of Parma, from 10,500,000 to 17,500,000 lire ; the Società Materiali Elettro-Trazione, of Florence, from 1,000,000 to 2,430,000 lire ; the Società Elettrica Radio di Sperone, of Avellano, up to 1,000,000 lire ; the Società Iesina di Elettricità, of Iesi, from 800,000 to 1,200,000 lire ; the Società Imprese Elettriche, of Macerata, from 1,200,000 to 1,500,000 lire ; the Società Industrie Elettriche Calabresi, of Radicena, increases from 2,000,000 to 3,000,000 lire, and amalgamates with the Società Elettrica Ionica, of Siderno ; and the Società Fabbrica Apparechi Riscaldamento Elettrico, of Milan, from 2,000,000 to 5,000,000 lire.

The Officina di Energia Elettrica, of Novara, has reduced its capital from 2,000,000 to 800,000 lire by assigning to its shareholders 8,000 12-lire shares of the Società Padana di Elettricità for one of the Officina.

Book Notices.—"The Problem of Dock Labour." By Arthur Shadwell, M.A., LL.D. Reprinted from *The Times*. London : Longmans, Green & Co. Price 1s.—This is a most thoughtful and valuable pamphlet. Every student of the pressing social and industrial problems of these critical times should secure a copy and read it carefully.

"Industrial Arts Index." Vol. VIII, No. 4. April, 1920. (62 pp.). New York : The H. W. Wilson Co.—A comprehensive index to articles which have recently appeared in engineering, trade and business periodicals, placed under subject-headings.

"Welfare Work." Vol. I, No. 5. (16 pp.).—The May number of the *Journal* of the Welfare Workers' Institute contains articles by E. D. Newcomb, "Foremen and Forewomen," and A. Rowland-Entwistle, "The Democratisation of Industry."

"Armature Winding and Motor Repair." By D. H. Bradymer. Pp. xxi + 515 ; figs. 298. London : Hill Publishing Co., Ltd. Price 18s. net.

"Engineers' Desk-Book and Diary." 1920. Leeds : Trades Publicity Co.—This handy publication contains a brief calendar, a diary giving ample space for notes and 96 pages of indexed information of a comprehensive character, including trade statistics and legal notes, as well as a small railway map of the British Isles.

"Ozone." By E. K. Rideal. Pp. ix + 198 ; 24 figs. London : Constable & Co., Ltd. Price 12s.

"Questions and Solutions in Telegraphy and Telephony." By H. P. Few. London : S. Rentell & Co., Ltd. Price 5s. 6d.—This useful handbook is now in its fifth edition—the last was published in 1914. It has been brought up to date by the addition of the papers and solutions of the City and Guilds of London Institute in Grade 1 of Telegraphy and Telephony for the last five years. Although the papers given in the first part of the volume no longer represent current practice, they are retained as illustrative of the various steps of progress.

"Induction Coil Design." By M. A. Codd. Pp. viii + 238 ; figs. 165. London : E. & F. N. Spon, Ltd. Price 21s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LVIII, No. 291. May, 1920. London : E. & F. N. Spon, Ltd. Price 10s. 6d.—The May issue contains the following papers :—"Scientific Management : A Solution of the Capital and Labour Problem," by Capt. J. M. Scott-Maxwell ; "Wireless Telephony on Aeroplanes," by Major C. E. Prince ; and "The Protection of Alternating-Current Systems without the use of Special Conductors," by Major K. Edgcumbe.

"Science Abstracts" (A and B). Vol. XXIII, Part 4. April 30th, 1920. London : E. & F. N. Spon, Ltd. Price 2s. 6d. each.

"The Peat Resources of Ireland." (25 pp.). A lecture given before the Royal Dublin Society on March 5th, 1919, by Prof. Pierce F. Purcell. London : H.M. Stationery Office. Price 9d. net.—This is described in a prefatory note by the Director of Fuel Research as "a clear and fair-minded exposition of the situation . . . written by an expert with a wide and intimate knowledge of the subject." The first part of the lecture is devoted to a description of the various forms and characteristics of peat deposits, and then the elimination of water, which forms the greater part of bog peat, is dealt with. Figures of the present-day consumption are given, as well as an estimate of the quantities available—a figure of 3,700 million tons of anhydrous peat. Tables comparing the peat and coal deposits of Ireland and the areas of the peat deposits of the world are included. The various methods of winning peat are described, and the production of power from this fuel is illustrated by an efficiency diagram.

"The Motor Ship." Vol. I., No. 3. (30 pp.). London : Temple Press, Ltd. Price 1s.—The June number of this well-produced and highly illustrated journal contains an interesting description of the 10,000-ton motor-tank ship *Narragansett*, built by Messrs. Vickers. The largest American motor-ship is also described among other informative articles.

"Vickers News." Vol. II, No. 17. June 1st. (20 pp.) London : Vickers, Ltd.—Presenting articles on "Trans-Continental Flying," "Transformers in Collieries," "A Simple Form of Refrigeration," &c., all well illustrated.

Bankruptcy Proceedings.—A. E. Channon, H. S. Nadin, and C. G. Channon (trading as A. E. Channon & Co.), electrical engineers, 8, Orrisdale Terrace, Cheltenham, and 425, High Street, Cheltenham.—The public examination of these debtors was held on May 27th, at the Court House, Cheltenham, before Mr. Registrar Williams. In reply to the Official Receiver, the debtor, H. S. Nadin, stated that he had acted as managing partner, and that the partnership commenced in January, 1919. He had had various occupations before commencing in partnership. They started business without any stock or capital. They had an offer of goods up to £250 on credit. The Official Receiver stated that the business had been carried on at a loss, owing to want of business knowledge, want of capital and negligence in book-keeping. Debtor admitted several losses on contracts which partly accounted for their deficiency. He also admitted that a statement prepared and sent to one of the creditors was misleading, though he suggested that he did not know it at the time. This creditor, who had removed debtors' goods just before the petition to the value of £200, had now written to the Official Receiver, that these goods were now held at the Official Receiver's disposal. The debtor, A. E. Channon, generally agreed with the answers given by the previous partner. He declared that by a deed made in September, 1918, he gave all his furniture to his wife, but the Official Receiver remarked that the wife had now withdrawn her claim. C. G. Channon was also examined as to the conduct of the business. On the application of the Official Receiver, the examination of the debtors was adjourned : meanwhile, Nadin was ordered to furnish a cash account of receipts and payments during the partnership.

W.P. O'Reilly, manufacturing electrician, 397, Edgware Road, and Old Broad Street, E.C.—Last day for proofs for dividend June 18th. Mr. D. Williams, Official Receiver, trustee, Carey Street, W.C.

Trade Announcements.—The offices of the Peninsular Engineering Co., Ltd., have been removed to Amberley House, Norfolk Street, Strand, W.C. 2. Telephone number unchanged. Telegrams "Pensuleco Estrand London."

The Hackbridge Cable Co., Ltd., have now closed down their London offices, and all communications should be addressed to the company at Hackbridge, Surrey.

The Metropolitan-Vickers Electrical Co., Ltd., have removed their London office from Norfolk Street to No. 2, Central Buildings, Westminster, London, S.W. 1.

Mr. Farmer, electrical engineer, of Broadhurst, Skelmersdale Road, Clacton-on-Sea, has entered into partnership with Mr. C. R. Small & Wall Bros., and the firm will trade as The Clacton Electrical Co.

The Twiss Engineering & Electric Transmission, Ltd., announce that they have now concluded arrangements whereby they acquire the Transmission Line Contracting Department of Messrs. J. B. Saunders & Co., Ltd., which will therefore become incorporated in the company's organisation, together with the services of Mr. S. G. Leech, M.I.E.E., as the director of contracts, with a staff of erecting engineers, linesmen, &c. The Twiss Engineering & Electric Transmission, Ltd., are also expanding their works at Mildmay Park, and laying down new plant to facilitate the manufacture of transmission line material. The directors have also decided to simplify and shorten the name of the company by the deletion of the words "engineering and," and the necessary formalities having been completed, the name of the company will in future be : Twiss Electric Transmission, Ltd. The head office remains at 62/63, Queen Street, E.C. 4. The capital of the company has been increased in order to deal with the increasing volume of business.

Mr. Thomas J. Digby, electrical engineer and contractor, has removed his offices and stores to 12, Gerrard Street, London, W. 1.

The address of Mr. James Ferguson, electrical instrument maker and engineer, has been changed to Stepps Engineering Works, Stepps Road, Glasgow.

Messrs. Downes & Davies, of Liverpool, have removed their Manchester offices and stores to 25/27, Faulkner Street, City.

Catalogues and Lists.—MESSRS. F. J. SHENTON & CO., LTD., of 68 and 69, Shoe Lane, London, E.C. 4, have sent us a couple of calendar novelties on behalf of Messrs. Flather & Co., Ltd., dynamo and motor manufacturers, of Park Electrical Works, Leeds, for whom they are sole representatives. One takes the form of a glass paper-weight, with changing calendar affixed at base thereof. The other is a daily tear-off date pad for use on the wall; it has bold red figuring.

MESSRS. WARD & CRICHTON, 41, Chapel Walks, South Castle Street, Liverpool.—A booklet and two leaflets dealing with the "Tompkins" Boiler Steam Dryer (Patent No. 113,701), and illustrated by detailed drawings. The agent for Scotland is Mr. I. Ferguson, 27, Oswald Street, Glasgow.

THE COX-CAVENDISH ELECTRICAL CO. LTD., Twyford Abbey Works, 84, Acton Lane, Harlesden, N.W. 10.—"The X-Ray Examination of Materials" (20 pp.), a reprint from the *American Machinist* giving full details and illustrations of the apparatus required for this work. The paper is priced, and directions for treating films are given.

THE OVERSEAS ENGINEERING CO., LTD., 75, Curtain Road, E.C.—List 23, a folder illustrating and describing the "Overseas" electric lighting plant. Full details of working costs are given.

THE J.L. ELECTRIC CO., 30, Church Street, Birmingham.—Particulars and samples of a universal cable clip, to secure cables from 1/·044 single up to 7/20 twin, in C.T.S., lead-sheathed, or armoured types, which can be supplied from stock.

MESSRS. MICKELWRIGHT, LTD., Alperton, Wembley, Middlesex.—Pamphlet illustrating and describing arc and sliding resistances, dimmers, shunt regulators, switchboards, &c.

MESSRS. HIGGS BROS., Dynamo Works, Sand Pits, Birmingham.—"Monthly Magazine," Vol. 2, No. 4, June, 1920 (24 pp.). The present issue contains the usual features, including a stock list of motors and dynamos, and "Hints and Tips," giving notes on turning commutators.

MESSRS. BUCK & HICKMAN, LTD., 2 and 4, Whitechapel Road, E. 1.—An eight-page booklet dealing with machine tools, gauges, &c., and the "Buckman" training centre where prospective purchasers may not only see the desired machines running, but may, in addition, have work of their own operated upon.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-12, Tottenham Court Road, W.—Publication No. 279, being a revised price list to the eleventh edition catalogue. Catalogue number and prices only are given.

AUTOMATIC AND ELECTRIC FURNACES, LTD., 281-283, Gray's Inn Road, W 1.—Heat Treatment *Bulletin* No. 22. "The Hardness of High-Speed Steel," illustrated by two curves of hardness tests.

Japanese Financial Crisis: Shipment of Goods.—The *Bulletin* of the F.B.I. this week contains the following notice:—"In view of the present financial crisis in Japan, members who are in doubt as to their position in connection with goods for shipment to that country are advised to communicate in the first instance with the Japan Section, Overseas Trade Organisation, F.B.I., 39, St. James's Street, S.W. 1.

Auction Sale.—By direction of the Disposal Board, Ministry of Munitions, MESSRS. OLIVER APPLETON & KITCHEN will sell by auction, on June 15th and following days, at the C.D.S. stores, Benbow, near Leeds, a quantity of electrical plant, fittings, engines, Lancashire boilers, machinery, and miscellaneous stores, &c. For particulars, see our advertisement pages to-day.

Manchester Turbo-Generators.—At the annual meeting of shareholders of MESSRS. RICHARDSONS, WESTGARTH & CO., LTD., held at Hartlepool on Monday, Mr. D. B. Morrison, who presided, said a notable contract in the "land" department of their engine works was a 25,000-KW. electric generating set for Manchester, of which they supplied the turbine and condensing plant and Metropolitan-Vickers the generator. This set was the largest in operation in the United Kingdom, and although the technical requirements were very severe, they had been successfully met, and the plant continued to give highly satisfactory results.

Derby Housing Scheme.—The Derby Town Council has received communications from the Derby Engineering Co. with respect to the wages and conditions of labour of men employed in connection with the electrical work on the municipal housing scheme. It has decided to inform the electrical contractors that they must observe the fair wages clause or the contracts will be cancelled.

Generating Plant for Sale.—Ipswich Corporation Electric Supply Department has for disposal two 80-I.H.P. Reavell high-speed tandem compound engines, direct-coupled to two 24-KW., 230/260-volt D.C. shunt-wound generators; also one 200-KW., 460/520-volt Electrical Co.'s D.C. generator. For particulars see our advertisement pages to-day.

Wigan Corporation Electricity Committee invites offers for one Willans high-speed compound engine (3 S. size), complete with Korting ejector condenser, direct coupled to 560-V. Dick, Kerr generator, &c. See our advertisement pages to-day.

Light-Weight Motors.—Referring to a note under this heading which appeared in our issue of December 13th, 1918, MESSRS. NEWTON BROTHERS (DERBY), LTD., inform us that the machine in question was probably one of their dynamos, as illustrated and described in their "Aircraft Dynamo Electric Machinery Supplement." This machine has an output of 500 watts at 12 to 14 volts, and weighs only 12 lb. Many other types of extreme lightness have been developed by the company for aircraft, vehicle motors, &c.

LIGHTING AND POWER NOTES.

Athlone.—ELECTRICITY SUPPLY.—The total cost of the new electric lighting scheme, promoted by the Urban Council, is now stated to be £20,000, but an estimate for a second scheme amounts to £17,653. The gross financial result is estimated as follows:—Revenue, £4,360; working expenses, £2,082; balance, £2,179; loan charges, £2,000; and net profit, £378. Mr. Kenny, representing Messrs. Tiesney, consulting engineers, said the cost of electricity would be 1s. per unit. For public lighting 120 lamps would be provided. A Committee of the Council is considering the whole matter.

Australia.—NEW UNDERTAKINGS.—A large number of townships in Victoria have schemes for electricity undertakings in hand or under consideration; among these are the towns of Stowell, Avoca, Beaufort, Colac, Mount Gambier, and Kyneton.

Birmingham.—CANAL STRIKE.—The electricity supply department was seriously affected by the recent strike of canal boatmen, as practically the whole of its fuel is water borne. While the strike was in progress, officials and members of the staff undertook the boatmen's work, and in this way a minimum supply of coal was got through to keep the service going. When a tentative settlement was reached, the Corporation boatmen, who had ceased work in sympathy with the other boatmen, resumed their duties.

Bolton.—PRICE INCREASE.—The electrical engineer reported, on May 27th, on the need for increasing the price of electricity. The Committee decided to advance the charge for both lighting and power by a tenth of a penny per unit. The request of the Chamber of Trade for a preferential rate was declined.

Bo'ness.—EXTENSION SCHEME.—Mr. Munro, consulting engineer, has reported to the Town Council on the proposed extension of the electricity works, and a decision regarding this will be made at a meeting of the Council at an early date. The cost of the scheme is given as £40,000.

Burnley.—EXTENSIONS.—On May 27th the chairman of the Electricity Committee reported that tenders had been obtained for the proposed extensions at the electricity supply station and for the installation of the required plant. The lowest tender at the present time was £120,000, and at least 16 months would be required in which to complete the work. The amount would be subject to variation in the event of increases occurring. The £120,000 was made up as follows:—Three water-tube boilers, with superheaters, economisers, valves, &c., £39,200; one 3,000-KW. turbo-alternator, with condenser, pumps, &c., £27,100; external pipe-work and valves, £6,270; water strainer, with motor pump, £577; cooling tower, £5,200; Venturi meters, £232; boiler feed-pump, £473; 1,000-KW. rotary set, £7,097; switchgear, booster, and cables, £6,600; ash-handling plant, £2,200; constructional work, cable and pipe trenches, £12,000; and contingencies, £13,051. It was anticipated that further rises in wages and materials would occur before the completion of the work, and the final cost would be greater than the £120,000.

The Council intends to apply for borrowing powers for the latter amount, and for an additional £20,000 for electricity mains.

China.—SHANGHAI.—Contracts for electrical generating plant for power and lighting are probable in connection with projects for supplying electricity outside the Settlement limits at Shanghai. In the ordinary course the proposed extensions of the electricity department of the Shanghai Municipal Council, as set out in March last, would have covered such requirements, but the extensions have been opposed on the ground that they are for the benefit of mills and factories outside the Settlement limits, which pay no taxes to the Municipal Council. It is probable, therefore, that independent power stations may be erected for such outlying establishments. Already works are being erected in Chinese territory in order to obtain power from the native city station. A way out of the difficulty has been provided by the proposal that outlying factories requiring current for power purposes should take up municipal debentures, but a very general response to this scheme is not anticipated.—*Eastern Engineering.*

Colne.—PRICE INCREASE.—The Town Council has decided to increase the charge for electricity for lighting from 4½d., plus 75 per cent., to 8d. per unit allowed under the provisional order; for power purposes, from 85 per cent. to 95 per cent.; and for heating, from 75 per cent. to 85 per cent. on the scale charge of 1½d.

Continental.—SWITZERLAND.—The Nordostschweizerische Kraftwerke A.-G. (N.E. Swiss Power Works), which increased its capital from 18 million to 36 million fr. in 1918, is now about to effect a further increase of 34 million fr. The following particulars concerning the future development of supply and demand and the construction of new power stations are extracted from the company's report of January 30th, 1920:—

In the financial year 1918-19 production amounted to 222·22 million KW.-hours, as against 185·06 million KW.-hours in 1917-18. It is estimated that requirements for the current year will increase by 13 per cent. As a return of pre-war coal prices cannot be looked for within a measurable time, electricity will be able to compete with coal for many years to come. Its use in the home, for hot water supply, and for metallurgical purposes has increased. The electrification of the railways is proceeding apace. Only for

electrochemical purposes has the demand materially decreased and the present stagnation will, no doubt, continue until such time as the products of the industry are in a position to compete with foreign prices.

In view of the fact that the Swiss power stations are unable to cover home requirements, the N.O.K., which is responsible for the electricity supply of North-East Switzerland, is aiming at the construction of new power stations, so as to make the country independent of foreign supplies. It had been hoped that the concession for several small stations in the canton of Glarus would have been granted, but unexpected difficulties have arisen. The concession has, however, been obtained for a low-pressure station in the Canton of Aargau, viz., the Böttstein-Gippingen Power Station. In addition, subject to the sanction of the Administration of the Swiss Federal Railways, the project for the construction and working of the Etzel Power Station jointly by the S.F. Railways and the N.O.K. has been prepared and, finally, it is hoped that the construction of the Wäggital power station can be carried out in conjunction with the town of Zürich.—*Economic Review.*

GERMANY.—According to plans prepared by Mr. Hallinger, of Munich, it is proposed to divert water from the high level rivers in Southern Germany to the low level system of the Main. The fall of the River Lech, for instance, which now flows south and joins the Danube, would be increased from 300 ft. to 1,080 ft., resulting in a total of 500,000 H.P. if arranged with open canals and falls at three points. The first fall would be at Nurnberg, where 200,000 H.P. is obtainable, the second at Wurtzburg, delivering 150,000 H.P., and the balance of 150,000 H.P. at Frankfort, as against 60,000 H.P. if the river is to continue to flow south as at present. Coal-fired installations to produce the same power would require 3,000,000 tons of good quality coal annually, which at the present price in Germany is worth £15,000,000.—*Technical Review.*

AUSTRIA.—A report on the development of water-power and electricity works has been presented to Vienna Town Council.

In view of the present restrictions in the use of electricity and the high prices, the Council was compelled to ascertain the quickest and cheapest method of obtaining water power. In contrast to the length of time required for the Danube power works, the Ybbs and the falls of the Alpine water-system near Kienberg-Gaming, can be developed in three or four years. Also the technical preparation for the Ybbs works are so far advanced that in a few weeks the sanction for proceeding may be expected. The average yearly output of the Danube works would be 140,000 H.P., and of the Ybbs works 18,000 H.P. The cost of the former is estimated at the lowest at Kr. 211 mill. (peace value), of the latter at Kr. 30.8 mill. The production of the electrical works amounts at present to 250 mill. KW.-hours, and will be increased to at least 320 mill. The yearly increase of electrical output averages 18½ mill. KW.-hours, and will in future be still greater because the gas lighting from foreign gas coal is to cease and electricity alone to be used, especially in the largest industrial district of Austria between Vienna and Vienna-Neustadt. A yearly increase of 200 mill. KW.-hours can, therefore, be estimated. In 15 years' time, the earliest date for the completion of the Danube works, the municipal electricity works would be producing 620 mill. KW.-hours. But the Danube works will supply only 365 mill. and the Ybbs works 200 mill., leaving a balance to be supplied by steam. For this reason a large increase of coal production is essential.

It has been decided that Vienna shall establish a co-operative company in which the Province of Lower Austria, the State Railways and the Danube Control Commission will participate, that the commune of Vienna shall proceed with the immediate development of the Ybbs Valley Works, and approach the Government and Lower Austria for active support in this matter.—*Economic Review.*

NORWAY.—Plans are under consideration for the conveyance of electricity from Norwegian waterfalls to Denmark. This would necessitate the construction of a cable about 100 km. in length, extending across the Skager Rack to a point on the coast of Jutland between Hirtshals and Hanstholmen. The longest cable at present in existence connects Helsingborg with Elsinore, a distance of only 7 to 8 km. It is estimated that the total cost of carrying out these plans, including the erection of stations and the extension of the exploitation of the Norwegian waterfalls, would amount to Kr. 30 to 40 million.—*Economic Review.*

SPAIN.—A commission of the Portuguese Ministry of Public Works has arrived in Madrid with the object of drawing up an agreement in connection with the division of power to be obtained from the Douro. It is estimated that a total of 450,000 H.P. is available from this source.—*The Times.*

Derby.—PUMPING PLANT.—Owing to the initial expense, the Town Council has decided not to install electrical pumping plant at the Little Eaton Waterworks.

Dublin.—PROPOSED PRICE INCREASE.—The Corporation has given notice of application made to the Ministry of Transport for an order under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, to provide that the maximum rates of charge within the municipal area, shall be increased by 50 per cent., viz., from £2 to £3 for any amount up to 60 units, and from 7d. to 10½d. per unit over 60 units, so as to enable the electricity undertaking to be carried on without loss.

STRIKE.—The strike of the Irish railwaymen who object to the importation of arms and ammunition extended on May 27th to the L.N.W.R. power house employés. This station not only supplies the power for cranes, &c., but also for lighting the railway hotel.

Dungarvan (Co. Waterford). — ELECTRIC LIGHTING SCHEME.—A representative public meeting has approved a scheme for public electric lighting, the power to be derived from the Colligan river. Nearly half the required capital (£11,000) was promised at the meeting.

Halifax.—SLIDING SCALE.—The Tramways and Electricity Committee has decided that as from the last meter reading taken for the June quarter, the following clause in the power supply agreement shall apply to all power consumers of electricity, viz. :—"If in any quarter the average price of coal (pea slack) delivered at the Corporation's electricity works is above or below 8s. per ton, the price per unit to be paid by the consumer shall during such quarter, be increased or reduced by 2½ per cent. for every 6d. or portion of 6d., provided, however, that no such increase or reduction shall be made or allowed unless the average price of coal exceeds 9s. per ton, or is lower than 7s. per ton."

Heston and Isleworth. — YEAR'S WORKING. — The report upon the electricity undertaking for the past year shows that the sale of energy produced was £21,721, against £17,019 for the previous year; meter rents realised £284, against £255; and public lighting £2,140, against £1,368. Fuel cost £8,926, compared with £6,557; and wages rose to £2,009 from £1,559. A profit of £442 was made, this being £6 above the previous year's figure.

Japan.—HYDRO-ELECTRIC SCHEMES.—The organisation of the Hida-Gawa Electric Co. now under consideration is for the development of power from the Hida River, in the vicinity of Nagoya. An alternative scheme aims at the unification of the power supply of Nagoya and neighbouring districts under the control of the Nagoya Electric Light Co., which has bought half of the shares of the Bishu Electric Co., and is negotiating to secure control of the Ichinomiya Electric Light Co., the Inazawa Electric Co., the Gifu Electric Co., and the Yokkaichi Electric Co. As a result of the efforts of the governor, representatives of six big electrical companies in Miye Prefecture, the Hokusei, Iwakura, Tsu, Matsuzaka, Ise, and Toba, have been in consultation with regard to a possible combination of all the electrical companies within the Prefecture. With the double purpose of obtaining additional income and of controlling water rights, the authorities of Toyama Prefecture are contemplating the establishment of a large hydro-electric plant under Prefectural administration, to develop 37,000 KW. from the Joganji River. It is expected that this will be sufficient to supply all present demands for power within the Prefecture and leave a surplus to be sold to Kyoto and Osaka. Another power company recently organised in this district is known as the Etchu Electric Power Co., having been granted a licence to utilise the Wada River, from which it is expected to develop 10,000 KW.—*Eastern Engineering.*

Liverpool.—PRICE INCREASE.—An addition of 25 per cent. on the present charges is to be made after June 30th. This will not apply to charges based upon the cost of coal, and subject to adjustment according to increases or decreases. These will only be increased by 15 per cent.

London.—HAMMERSMITH.—The Electricity Committee strongly recommends the laying of mains for the supply of electricity to the new housing estate. The total cost is estimated at £27,000, including services. The system of charging favoured is the prepayment meter, the fixed price and limiter systems being considered a restriction upon the use of electricity for other than lighting purposes, while the Committee wishes to encourage the employment of the supply for all domestic purposes in order to cover the initial expenditure in a short time. If a tenant prefers an ordinary meter, this may be installed in lieu of a prepayment meter. Tenders are being invited for the erection of the first of the sub-stations required under this supply scheme.

Owing to increased costs, the estimated surplus of £3,582 at the end of March, 1921, will be changed to a deficit of £13,688 unless prices are increased immediately; and the Electricity Committee, therefore, proposes the following increases, to take effect from July 1st :—Lighting to be raised to 7d. per unit, and all supplies for power, heating, cooking, and industrial purposes to be increased by a further 50 per cent., bringing the prices up to double the pre-war rates.

The Works Committee recommends the purchase and conversion of 73 gas-lamp standards to electricity, at a total cost of £755. It is stated that the present yearly maintenance cost is £5 8s. 9d. per lamp, which will be reduced upon conversion to £3 18s. 1d.

SHOREDITCH.—The Electricity Committee deems its desirable to abolish the present system of charging for electricity which consists of adding percentages to the pre-war rate. A revised scale, to take effect from the June meter readings, is proposed as follows :—Lighting—maximum demand, 8d. for the first 1½ hours daily, and 3½d. per unit for all electricity consumed thereafter. Flat rate, 6½d. per unit; theatres and music halls, 6d.; and outside arc lighting and electric signs, 4d. per unit. Heating—1½d. per unit if taken in conjunction with a lighting supply. Power—30s. per quarter per E.H.P. of maximum demand, plus 1½d. per unit (maximum charge, 2½d. per unit). A special rate of 4d. per unit for trade and testing purposes is also proposed. Discounts varying with the amount consumed from 2½ to 10 per cent., are to be allowed. A new scale of meter rents is being introduced at the same time.

Lurgan (Co. Armagh).—ELECTRICITY SUPPLY.—Just before the war, the firm of Messrs. Wanside & Co., Belfast, submitted an electric lighting and power scheme to the Urban

Council, but the war intervening, the scheme was postponed. Mr. Pleasance, of the firm, recently waited on the Council and explained the great increase in the cost of production since 1914, and, as a result of the discussion, the firm was asked to bring the 1914 scheme up to date and re-submit it.

Mid-Lancashire.—ELECTRICITY DISTRICT.—The Electricity Commissioners have provisionally determined that the undermentioned area shall be constituted a separate electricity district for the purposes of the Electricity (Supply) Act, 1919, that is to say :—The county boroughs of Blackburn, Blackpool, Burnley and Preston. The boroughs of Accrington, Bacup, Chorley, Clitheroe, Colne, Darwen, Haslingden, Nelson and Rawtenstall. The urban districts of Barrowford, Brierfield, Church, Clayton-le-Moors, Croston, Fleetwood, Fulwood, Great Harwood, Kirkham, Leyland, Longridge, Lytham, Oswaldtwistle, Padiham, Poulton-le-Fylde, Preesall, Rishton, St. Annes-on-Sea, Thornton, Trawden, Walton-le-Dale and Withnell. The rural districts of Blackburn, Burnley, Chorley, Clitheroe, The Fylde, Garstang and Preston. It being apparent to the Electricity Commissioners that the existing organisation for the supply of electricity in the district so provisionally determined should be improved, notice is further given that they intend to hold a local inquiry into the matter. Objections or representations may be made not later than September 30th, 1920.

Morley.—YEAR'S WORKING.—The seventeenth annual report covering the year ended March 31st, 1920, shows that the total revenue for the year was £7,834, an increase of £2,907 on the previous year's figure. The total expenditure increased by £877 to £5,413, leaving a gross profit of £2,421. The net result, after payment of interest, &c., was a credit balance of £282, which, compared with a deficit of £1,759 for 1919-20, was very satisfactory. The report states that the plant is often subjected to overloads owing to its inability to meet the requirements of consumers. There is no reserve in case of a breakdown, and many applicants are waiting to be connected. Unless additional plant is installed before next winter it will probably be necessary to restrict the consumption of power during certain hours.

Plymouth.—YEAR'S WORKING.—The recently-published accounts for the year ended March 31st last show a total income of £92,957, against an expenditure of £69,785, and a gross profit of £23,172. The net result, after the payment of loan interest, &c., was a credit balance of £274, comparing favourably with the loss of about £2,000 on the previous year's working.

Rotherham.—PRICE INCREASE.—The Town Council has increased the charges for electricity as under as from the June 1st quarter :—Power and heating, to 100 per cent., and lighting to 50 per cent. above the pre-war rates.

Swansea.—STRIKE.—A lightning strike of power-house workers, on Wednesday last week, caused the suspension of electricity supply to the docks.

Worcester.—YEAR'S WORKING.—The accounts of the city electricity undertaking for the year ended March 31st show a total income of £33,116, compared with £32,235 for 1918-19. The cost of generation and distribution of electricity was £19,835, leaving a gross profit of £13,280. After payment of interest, redemption of capital and income-tax, there remained a profit of £1,224. Carried forward to the appropriation account, this makes, with last year's surplus, £4,406 ; £1,800 is being contributed to rate relief, and the electrical engineer (Mr. C. M. Shaw) suggests that the balance shall be placed to a reserve account. He points out that there is an urgent need for building up an adequate reserve. There is every probability that the demand upon the department will grow, and that a third turbo-alternator, of not less than 3,000-KW. capacity, may have to be provided within the next year or so. It would be of great benefit to the department if at least half the cost of the new equipment could be met out of a reserve fund. The number of units generated by water power was 563,020, compared with 615,703 in the previous year, and this had affected the cost of production. The total works costs were 1·52 per unit sold compared with 1·04 per unit last year. There was a likelihood that higher salaries and wages would have to be paid, and a possibility of a large increase in the cost of fuel. To meet the ½d. increase in the cost of production, and to provide a reasonable surplus each year to build up a reserve fund of at least £15,000, he recommends increases in the charges. These suggestions include :—Lighting to be increased to a flat rate of 7½d. per unit (with certain exceptions), charges for power supplies to be increased to 75 per cent. over pre-war rates ; a labour clause to be added to special contract agreements ; heating supply, by separate meter, from 1d., plus 20 per cent., to 1½d. per unit. The Electricity Committee recommends the adoption of these increased charges.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—FARES.—Hurst District Council applied to the Corporation Tramways Committee for a revision of the rates on the Hurst section, with a view to bringing the minimum stage from 1½d. to 1d., but the Committee replied that the introduction of the three-halfpenny fare was due to increased wages, &c., and any alteration would more probably be in the direction of an increase.

Australia.—ADELAIDE TRAMWAY TRUST.—The statement of accounts of the municipal tramway trust, Adelaide, for the half-year ended January 31st, 1920, shows that the total receipts for the period amounted to £242,894, contrasted with £218,550 for the corresponding term in 1919. The revenue per car-mile on the Adelaide service was 22·259d. ; expenses per car-mile, 14·770d. ; percentage of operating expenses to revenue, 66·080. On the Port Adelaide line the figures for the items enumerated were—18·305d., 13·408d., and 73·253d. The total expenditure incurred in operating the whole services amounted to £239,339, leaving a balance of £3,555.—*Commonwealth Engineer.*

STRIKE SETTLED.—The threatened strike of tramway employés at Melbourne was averted early last week, a compromise having been effected.

Bath.—PROPOSED FARE INCREASE.—The case of the Bath Electric Tramways, Ltd., showing the necessity for an immediate increase of fares was placed before a special City Council sub-committee by the general manager on May 20th. The company proposes an addition of ½d. to all ordinary fares, irrespective of distance, and an increase of 50 per cent. on workmen's tickets. Even with these additions, the company states that it will not have sufficient funds to carry out the track renewals required by the Council. The sub-committee viewed the proposals favourably and recommends their acceptance by the City Council. The consent of the Ministry of Transport has also been applied for.

Batley.—BREAKDOWN OF PLANT.—In consequence of a breakdown of a portion of the main generating plant at the electricity works, there was no supply during the whole of May 26th and 27th on the Thorncliffe Road and Healey car routes. The other sections were temporarily able to be supplied with power by neighbouring authorities till the plant was repaired. The lighting and power services were not affected.

Blackpool.—WAGE INCREASE.—By a further bonus advance on June 1st, the tramway employés have now an increase of 17½ per cent. on pre-war rates, whilst on the Fleetwood section the increase is much larger. The minimum wage for a motorman is now £3 16s. 6d. for a week of 48 hours. The total war advances are costing the Corporation £40,000 a year, the last 9s. increasing the wage bill by over £8,000 a year.

Bolton.—EMPLOYES' WAGES.—By a recent award the tramway workers are to receive an advance in wages of 3s. per week retrospective to March 29th last.

Bradford.—TRAFFIC DELAY.—About a hundred yards of the overhead wire on the Manningham section of the Corporation tramways became detached on the night of May 24th, and caused much congestion of traffic on the road for upwards of half an hour.

Continental.—SPAIN.—According to statements by the financial Press of Brussels, confirmed by that of Bilbao, a Spanish syndicate, formed by the Banco Vizcaino and the Hidroelectrica Ibérica, is in treaty in Belgium for the purchase of all the shares in the Bilbao tramway company. The capital of this company consists of 7·5 mill. fr. in shares of 100 fr. each, and of as many founders' shares, the value of which is not stated. The purchase price is said to be 40 mill. fr. The chief Belgian shareholders of the company are the Société Financière de Transport ; the Société Generale d'Entreprises Electriques ; the Société Generale Belges des Chemins de Fer, and the Banque de Bruxelles, the latter holding founders' shares only.—*Economic Review.*

PORTUGAL.—The Lisbon tramcars ceased running on May 23rd, owing to the rejection by the Socialist members of the city council of an arrangement negotiated by a special committee permitting modifications of the conditions of the contract, including an increase in fares on account of the high price of coal and increased working expenses. There were no disturbances. The municipality has appointed a fresh committee, mainly Socialist, to deal with the question.—*The Times.*

Greenock.—PROPOSED MUNICIPALISATION.—The Corporation has appointed a Committee for the purpose of negotiating with the local Tramways Co. regarding the proposed purchase of the system by the town.

Huddersfield.—YEAR'S WORKING.—The report on the tramway undertaking for the year ended March 31st, 1920, shows that the capital outlay up to date was £477,607. The income was £261,147 ; wages, £70,726 ; power, £35,733 ; total working expenditure, £217,526, leaving a gross surplus of £43,620. The net surplus, after deducting redemption of debt, depreciation, &c., was £485. Reserve accounts show a net total of £64,835.

Twenty-four cars are to be ordered, in addition to the six in course of erection.

TRAMWAY SERVICES.—It is stated that if the Halifax Corporation extends its tramway system to Elland, *via* Woodside, the Huddersfield Tramway Committee will seriously consider the question of pulling up the tramway lines between Elland and West Vale. This service has proved a most profitable one, and the Greetland people, whom it serves primarily, are showing concern at the prospect of being neglected. If the Halifax project comes into being, there will not be sufficient passengers to warrant a service to West Vale only.

Keighley. — Extensions. — The railless trolley-car system of the Corporation is about to be extended, it is stated, as far as Oxenhope (at the head of the Worth Valley). At present the service stops at Lees (Haworth). In 1916 the overhead equipment was erected as far as Oxhenhope, but the Local Government (Emergency Provisions) Act of that year barred further progress. Despite the difficulties with the present railless-trolley system on the other routes, by reason of the shortage of cars and the need for repairs, the Corporation is endeavouring to put the new service into operation at an early date.

London.—Floods.—A thunderstorm broke over south-west London on Wednesday evening last week, and the torrential rain caused considerable dislocation of traffic. At Ealing the tramway and District Railway services were interrupted owing to the flooding of the tracks. The Richmond railway service on the District line was suspended owing to the track being flooded to a depth of 12 in. at Chiswick Park, and a train on this line was derailed about 9 p.m. by damage to the track. At Kew Bridge the London and South-Western Railway was flooded to platform level, and the water entered the driver's compartment of an electric train.

An electrical defect at Holloway Road caused a suspension of traffic north of York Road on the Piccadilly Tube Railway on the same day.

Tramway and omnibus stopping places are being considered by the Ministry of Transport.

Fare Increase.—An arrangement has been come to between the London United Tramway Co. and the local authorities in Middlesex and Surrey that the company shall add 50 per cent. to its fares, as from June 1st, except in the case of workmen's fares, which are to remain unaltered. The company's lines run for more than 100 miles in the southern and western outer suburbs of London.

Whitsun Traffic.—During Whitsuntide the number of passengers carried on the trains, omnibuses and tramcars operated by the Underground Co. was as follows :—Saturday, 4,500,000 ; Sunday, 4,250,000 ; Monday, 5,250,000. The Whit Monday figure is considerably in excess of any previous record of passengers carried on any one day.—*The Times.*

Point failure on the City and South London Railway held up trains between Euston and the Angel for three-quarters of an hour early on Monday.

United States.—Railway Strike.—The employés of the Brooklyn Rapid Transport Co. struck for higher wages on May 28th, causing the closing down of the Brooklyn elevated railroads to the great inconvenience of the travelling public.

Rothwell.—Opposition to Extension.—The Urban District Council has affirmed its opposition to any extension of time being granted to the local tramway company for completing its schemes, powers for which have been obtained.

Swansea. — Strike Ended. — After five weeks of inactivity, the tramway services were resumed on May 30th, the employés returning to work, and unconditionally accepting the Joint Industrial Council's recent award.

Tramway Workers' Wages.—The meeting of the Joint Industrial Council of the Tramway Industry, held on May 28th, was concluded without a settlement being arrived at. The employers wished to introduce a scale of increases varying from 1s. to 3s., according to the district, but the employés' representatives hold out for a uniform increase of 9s. (on the old rates) for all districts. The employés in Scotland have refused to submit their claims to arbitration.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—Canada.—Representatives of newspapers from all the provinces attended the annual meeting of the Canadian Press Association held at Toronto last month. *The Times* understands that proposals for the improvement of the cable services, which are entirely within the control of the Canadian Press, were approved. While expressing gratitude to the British Government for its offer of financial aid, the Association decided not to burden the British tax-payers, but it is prepared, from its own resources, and with such aid as the Canadian Government may grant, to improve the Imperial news services.

West Indies.—Cabling facilities from Trinidad are, according to the *Financial Times*, worse than ever. The repair ship of the West India and Panama Telegraph Co. has been for a considerable time laid up at Port of Spain for repairs, which are not expected to be completed for some months yet. Meanwhile the old cable is said to be breaking down in all directions, and the company is unable to obtain the services of a repair ship. Wireless telegraphy does not afford much relief as far as the West Indies are concerned. Messages from London reach Canada, but from thence it is quite uncertain how they are forwarded.

Finland. — Wireless Telegraphy. — A system of wireless telegraphy for Press messages will shortly be established between Helsingfors and Copenhagen. The Danish arrangements are complete, but the Finnish Military Authorities have not yet given their consent to the use of the Finnish wireless stations.—*Economic Review.*

France. — Telephone Subscribers' League.— The outcry against the telephone service has become so insistent that subscribers with grievances have formed themselves into a league, the object of which is to guard the interests of telephone users generally. The council of the league, says the *Daily Telegraph*, includes several hundred subscribers, and its duty will be to receive and examine all complaints of its members, and to suggest to the authorities improvements that might be effected.

Imperial Wireless Communication. — Committee's Report.—The Cabinet is now in possession, says *The Times*, of the report of the Imperial Wireless Telegraphy Committee appointed last November. The report, which has not yet been published, is unanimous.

Liverpool.—Wireless Demonstration.—The Applied Electricity Department of the University recently held a three days' demonstration of Marconi apparatus marvels, including a portable wireless telegraph and telephone set. The demonstration was of considerable interest to shipowners and those engaged in the electrical business. University students attended in large numbers.

London.—Storm Damage.—As a result of last week's thunderstorm, over 1,000 telephone subscribers were cut off—about 500 at Chiswick, 600 at Waltham Cross, and 60 at Hammersmith. The defect, which was soon put right, is said to have been due to the sudden rise of water in manholes where work was in progress, the water reaching the cables before they could be sealed.

Wireless Telephony.—For the first time in the history of British journalism, spoken news messages for publication were received by wireless telephony from Chelmsford, Essex, direct by means of the receiving apparatus recently installed at the *Daily Mail* offices, London. The news was transmitted from the Marconi station, and related to local affairs and to the demonstration before members of the London Chamber of Commerce and the Chartered Institute of Secretaries, which took place on May 26th, and listeners-in at different parts of the country, at distances varying from 100 to 450 miles, reported that the messages were heard distinctly.

Pacific Cable.—Proposed Duplication.—Mr. Milward, manager of the Pacific Cable Co., announces that a project is under consideration to duplicate the Vancouver to Norfolk Island cable. The cable cannot be completed until 1921. It will cost nearly £4,000,000. The Pacific "All-Red" cable, which was completed in October, 1902, was the outcome of the desire for an all-British telegraphic route between Great Britain and the Dominions. The distance from Vancouver to Norfolk Island, whence the cable proceeds to New Zealand and Australia, is 6,000 miles. There are two intermediate stations between Vancouver and Norfolk—namely, Fanning Island and Fiji. The cable between Vancouver and Fanning is the longest hitherto laid in one piece.—*The Times.*

Private Wireless Installations.—Fire Risk.—The range and capacity of many privately owned and operated wireless stations have been greatly increased, and many of these stations are located in private dwellings which are equipped with combination gas and electric lighting fixtures, the electric lighting equipment being connected to a 110-volt A.C. system which is grounded. Details are given in the *Electrical Review*, of Chicago, of a case in which trouble was experienced owing to fuses blowing and static discharges and even arcing in the fixtures, &c., when the wireless equipment was in use. Investigation showed that with the sending set in operation, the wiring of the house was subjected to an induced pressure of about 5,000 volts in addition to the line voltage. Further tests must be made before definite conclusions can be drawn, but it is suggested that :—(1) Insulating joints be not permitted on electric lighting fixtures in building containing wireless stations ; (2) the wiring of such fixtures should be with conductors having a rubber insulation at least $\frac{5}{64}$ in. in thickness ; (3) some provision be made for the draining of induced current from the ungrounded wire of the lighting system before the induced pressure reaches dangerous values ; (4) it may be necessary to insist upon wireless stations which take energy from a public service being connected to an independent transformer. It has still to be investigated to what extent parallelism between the antenna and the wiring affects the results.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—August 4th. N.S.W. Government Railways and Tramways. Two 1,000-kw. sub-station units. Chief Electrical Engineer, 61, Hunter Street, Sydney.

August 3rd. Department of Public Works. Turbines and generators for the Barren Jack hydro-electric development scheme. Department of Public Works, Sydney.

July 18th. City Council. Maximum demand indicators. Electric Lighting Department, Town Hall, Sydney.

Perth.—July 14th. P.M.G.'s Department. Telegraph and telephone instruments (various parts). Schedule 674.

June 16th. P.M.G.'s Department. Telegraph and telephone instruments (various parts). Schedule 680. (May 14th.)

ADELAIDE.—June 23rd. P.M.G.'s Department. Telephone parts (schedule 541). (May 21st.)

Barnes.—June 7th. Urban District Council Electricity Department. Coal-handling plant and overhead steel or ferro-concrete bunkers. (May 14th.)

Bedford. — June 21st. Electricity Department. One 2-ton locomotive jib crane, with grab and track rails, steam and other pipework. (See this issue.)

Belgium.—June 8th. Tenders are being invited by the municipal authorities of Horlon-Hozemont (Province of Liége) for the concession for the supply of electricity for lighting and power purposes.

The Belgian State Railway authorities at La Salle Madeleine, Brussels, are shortly inviting tenders for the supply of a quantity of material, in connection with the Stone train electric lighting system, including 636 dynamo suspensions, 1,075 battery cases and 636 driving pulleys, with safety guards.

June 19th. The Belgian Post and Telegraph authorities at La Salle Madeleine. Brussels, are inviting tenders for the supply of 1,710 kilometres of covered copper wire, comprising several varieties.

Carlisle.—June 25th. Electricity Department. One 3,000-KW. turbo-alternator and condensing plant. (May 28th.)

Crewe.—June 5th. Electricity Department. 12 months' supply of slack (about 4,000 tons). Borough Electrical Engineer.

Dublin. — June 7th. Electricity Supply Committee. 12 months' supply of single-phase and three-phase meters. (May 21st.)

June 10th. Electricity Supply Committee. Feed pump, tanks, pipework, &c., for Pigeon House generating station. (May 28th.)

Dundalk.—June 15th. Urban District Council. Electricity Department. 750 yd., L.T., 3-core, paper-insulated, lead-covered and armoured cable; disconnecting boxes (pavement type) and joint boxes. (May 28th.)

Edinburgh.—June 19th. Electricity Supply Department. E.H.T. and L.T. switchgear, &c., for Portobello station. (May 21st.)

France.—The French Post & Telegraph authorities in Paris have just invited tenders for the supply of 170 tons of bronze and copper wire, to be made from old wire supplied by the department.

Grimsby.—June 7th. Electricity Department. E.H.T. cables and pilot cables (specification No. 146). (May 28th.)

Ince-in-Makerfield.—June 15th. Urban District Council. Waterworks Department. Motor-driven pumping sets; cables; alterations to winding engine from steam to electric drive; switchgear. (May 28th.)

Leeds.—June 14th. Electricity Department. 12,000-KW. steam turbine, alternator and condensing plant. (May 14th.)

London.—HACKNEY.—June 9th. Electricity Department. Four water-tube boilers, each 33,000 lb. per hour capacity, with superheaters, mechanical stokers, &c.; four induced-draught plants; four fuel economisers; one 10,000-KW. turbo-alternator and exciter, with ventilating fan and air filter or cooler; one surface condensing plant; two circulating water motor-driven pumps; E.H.T. switchgear; two 20,000-KW. coupler panels; one 10,000-KW. generator panel; six 2,000-KW. and one 4,000-KW. feeder panels. (May 7th.)

BETHNAL GREEN.—June 7th. Electricity Supply Department. Two 500-K.V.A. transformers; one E.H.T. and one L.T. panel; L.T. feeder cables; section pillars and road work. (May 21st.)

WIMBLEDON.—June 12th. Electric Lighting Committee. Two boilers, with mechanical stokers, induced-draught fan and motor, pipework, steel chimney, &c. (May 28th.)

Manchester.—June 7th. Electricity Department. Main and auxiliary switchgear; Section A, 33,000-volt and 6,000-volt main switchgear; Section B, pressure-testing switchgear; Section C, 420-volt A.C. auxiliary switchgear; Section D, 240-volt D.C. auxiliary switchgear. (April 30th.)

New Zealand.—AUCKLAND.—September 1st. Harbour Board. For the supply of electric capstans and spares. Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, Cripplegate, London, E.C. 2.

Newport.—June 26th. Electricity Department. Turbo-alternating plant, surface-condensing plant, boilers, economisers, draught plant, steel flue and stack, &c. (See this issue.)

Nuneaton. — June 30th. Electricity Department. 1,000-KW., D.C., geared turbo-alternator, surface-condensing plant and pipework. (See this issue.)

Rochdale.—June 5th. Corporation. Electric lighting installation in 52 houses on Spotland site. Particulars from Architects' Office, Town Hall.

Salford.—June 5th. Electricity Department. 12 months' supply of D.C. and A.C. meters. (May 21st.)

Seychelles Islands.—An electric light system is being introduced in the Seychelles, and tenders for the lighting-up of Port Victoria, in Mahé, are invited in the latest issue of the *Government Gazette* to reach this country.—*Times Trade Supplement.*

Southampton. — July 3rd. Electricity Department. E.H.T. and H.T. switchgear and D.C. control panel. (See this issue.)

Spain.—The Spanish Government has just invited tenders for the supply of the material necessary for the equipment of 12 wireless telegraph and telephone stations in the Madrid military area.

Warrington.—June 15th. Electricity and Tramways Committee. Motors and transformers. (May 28th.)

CLOSED.

Belgium. — Four Belgian and one British concern (B.I. & Helsby Cables, Ltd.) submitted tenders recently to the municipal authorities of Antwerp, for the supply of the 10,690 metres of armoured electric mains required for the electrical equipment of the Nos. 2 and 3 docks at the port. The result of the tendering has not yet been made known.

Chesterfield.—Electricity Committee. Accepted :—
Feeder cables and the extension of cables, £3,775.—B. I. & Helsby Cables, Ltd.

Glasgow.—Town Council. Accepted :—
Gear wheels.—A. Wiseman, Ltd.
V.I.R. cable.—Liverpool Electric Cable Co., Ltd.; Western Electric Co., Ltd.
Car wheels.—J. Baker & Co.
Rotary converter and switchgear.—Met.-Vickers Electrical Co., Ltd.

The Health Committee has accepted the offer of Messrs. W. C. Martin & Co., for the installation of electric lighting, &c., at the Knightswood Hospital, the tender being £7,579.

Town Council. Accepted. Supplies for 12 months :—
Copper bonds.—B. I. & Helsby Cables, Ltd.
Armature coils.—Manchester Armature Repair Co., Ltd.
7/20 V.I.R. cable.—Liverpool Electric Cable Co., Ltd.
Trolley wire.—F. Smith & Co., Ltd.

Halifax.—Tramways and Electricity Committee. Accepted :
Babcock & Wilcox, Ltd.—One patent cross-type marine boiler for the electricity works, £10,710.
E. Green & Son, Ltd.—One economiser of 240 tubes, £2,063.
Crompton & Co.—Three new motors, £777; starting gear for same, £179.

Manchester.—Tramways Committee. Accepted :—
Trolley wire.—F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.)
Fishplates for tramway rails.—United States Steel Products Co.

Electricity Committee. Accepted :—
Laying cable.—Callender's Cable & Construction Co., Ltd.
Knife switches.—Ferguson, Pailin & Co., Ltd.; Park Royal Engineering Works, Ltd.; Whipp & Bourne, Ltd.
Extension to balancer board, Dickinson Street Station.—Whipp and Bourne, Ltd.
One 8300/10,000-KW. turbo-alternator and condensing plant for Stuart Street Station.—Richardsons, Westgarth & Co., Ltd. Contract and licence to sublet the alternator to C. A. Parsons & Co., Ltd., to be prepared and sealed.
Steel work on workshop, Barton Station.—F. Morton & Co, Ltd.

Salford.—Tramways Committee. Accepted :—
Metal-filament lamps during the year, 1s. 8d. each (approx. £750).—British Union Lamp Works, Ltd.

Electricity Committee. Accepted :—
Additions to buildings and construction of foundations for the 5,000-KW. turbo-alternator set, £3,230.—Smith & Briggs, Ltd.
Switchgear for the sub-station of the C.W.S. at Weastle, £1,234. Switchgear for controlling the supply to second feeder cable to Eccles, £264; one E.H.T. switch-cubicle, £274; two 600-K.V.A. transformers, in connection with the supply of electricity to the sewage works, £2,048.—Met.-Vickers Electrical Co., Ltd.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, June 5th. At Albemarle Street, W. At 3 p.m. Tyndall lecture on "The Theory of Quanta," by Dr. J. H. Jeans, F.R.S.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 5th. At the Wood Memorial Hall, Newcastle-on-Tyne. At 2.15 p.m. General meeting.

Royal Society.—Monday, June 7th. At John Street, Adelphi. At 7 p.m. Cantor lecture (postponed from April 26th) on "Aluminium and its Alloys," by Dr. W. Rosenhain.

Electrical Trades Benevolent Institution.—Monday, June 7th. At 36/38, Kingsway, W.C. At 2.30 p.m. General meeting.

British Science Guild.—Tuesday, June 8th. At Goldsmiths' Hall, Foster Lane, E.C. At 3 p.m. Annual meeting.

Institution of Electrical Engineers (Scottish Centre).—June 9th to 12th. Summer outing. June 11th. Visit to Kinlochleven.

(Wireless Sectional Meeting). — Wednesday, June 9th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 6 p.m. Paper on "High-frequency Machines," by Mr. M. Latour.

Institution of Mining Engineers.—Thursday, June 10th. At 11 a.m. At Burlington House, Piccadilly. Annual meeting. At 7 p.m. At the Connaught Rooms, Gt. Queen Street, W.C. Annual dinner.

Friday, June 11th. At 10 a.m. Visit to the Royal School of Mines and the Science Museum, South Kensington, S.W.

Institute of Metals.—Thursday, June 10th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. 1. At 8 p.m. Annual May lecture on "The Recent Progress in Thermo-Electricity," by Prof. C. A. F. Benedicks.

NOTES.

National Joint Board of Employers and Staff Members for the Electricity Supply Industry.—Following on the announcement regarding power-station engineers in our last issue, we are now able to give the recommendations as to commercial and clerical staffs, which have been settled by the National Joint Board. The following schedule of salaries is applicable to all electricity supply undertakings, statutory or non-statutory, for public or private supply in Great Britain and Ireland :—

Basic rates of wages or Salary per annum. £75 and under.	Amount to be paid as from April 1st, 1920. An additional £135 per annum to the basic rates. £240 per annum.
100	300
150	360
200	420
250	480
300	540
350	600
400	660
450	720
500	780
550	840
600	900
650	960
700	1,020
750	

The basic rates are based upon the net amounts paid on April 1st, 1919, after deduction of all awards, grants, and bonuses paid in respect of increased cost of living, and include all merit, scale, or grade increases granted up to that date. Any increases granted since that date are to be deemed to be increases in the basic rates as from the same dates that such increases were paid.

Where total salaries and bonus paid since April 1st, 1919, amount to more than the amounts shown in the table, no reduction is to be made. The increases shown are to apply to all male employés over 21 years of age only, except temporary ones. The rates to the extent of 75 per cent. are to apply generally to women employés over the age of 21 years who were in receipt of the basic rates set out in the table, but exceptional cases may be considered on their merits. The remuneration of juniors is not fixed.

The increases are to apply until January 1st, 1901, by which date it is anticipated a graded schedule will be agreed, or until a revised scale is adopted on account of a material variation in the cost of living.

British Oil.—It was officially stated on May 27th that so far as the research work in Derbyshire is concerned, which has received Government support, it will take another six months to establish whether oil can be obtained in sufficient quantities to make oilfields in Britain a commercial possibility.

Fatalities.—The *Daily Telegraph* reports that on Sunday night, while, at the entrance to the Forth Goods Station, Newcastle-on-Tyne, a gang of a dozen linesmen employed by the Newcastle and District Electric Lighting Co. was repairing a faulty main in Neville Street, the current was switched on unexpectedly. Two of the men, Thomas Farrar and Murray Kennedy, were immediately killed, while another, Thomas Lawrence, was injured.

At an inquiry held into the death of a foreman electrician named Henry Spurr, aged 37, who was killed while making alterations to the electrical installation at the Cerebos Salt Works, Greatham, near West Hartlepool, Mr. S. R. Bennett, H.M. Factory Inspector, mentioned that this case was the third in a fortnight in which death had been caused by the 220-volt current in the Tees-side district. The evidence showed that while Spurr was behind the switchboard at the works on Saturday, May 22nd, there was a flash, and he was found unconscious. Artificial respiration was used for 40 minutes without effect. Mr. Neve, works manager, said that immediately after an accident a year ago, when a boy touched a live wire and was killed, they had instructions to do certain work to bring the installation up to Home Office standard, and Spurr and others had been engaged on the work pretty continuously for six months. Mr. Edgar Phillips, the contractor, thought that Spurr had been using a screwdriver, and that his hand had slipped and caught a bare conductor. The jury returned a verdict of "Accidental death," no blame being attached to anyone. Mr. Bennett mentioned that in the view of the Home Office, artificial respiration in those cases should be kept up for two hours, and a notice to this effect was being issued.

Inquiries.—A correspondent desires information regarding the details of the treatment of wood separators with soda ash, for accumulators. Makers of small insulators, known as "fish-backbone" insulators, and French makers of Steatite for insulation, are asked for. Suppliers of "Micarta," "Bakelite," or substitutes, and Swedish iron rod and sheet are wanted.

The Association of Consulting Engineers (Inc.).—The annual dinner of the Association was held at the Connaught Rooms, London, on May 28th. Mr. H. J. Rofe, chairman of the committee of the Association, presided, and a thoroughly enjoyable evening was spent; some 70 members and guests were present and partook of an excellent menu, after which the usual toasts were honoured.

Following the toast of "The King," Mr. W. B. Clode, K.C., proposed the "Association of Consulting Engineers," and referred to the engineer as a romantic person who harnessed the powers of nature in the service of mankind. The Chairman, who responded, also proposed "Engineering Institutions," mentioning the good work done by the Institutions of Civil, Electrical, and Mechanical Engineers. He then outlined some of the aims and objects of their own Association. Capt. H. Riall Sankey, C.B., C.B.E., president I.Mech.E., and member of Council, Inst.C.E., replied, and pointed out that besides the Institutions mentioned by the chairman there were a number of others which fulfilled important functions in their respective spheres. He also referred to the desirability from all points of view of the registration of qualified engineers.

Mr. Roger T. Smith, President I.E.E., who also replied, said that the Institution of Electrical Engineers had long ago ceased to represent solely the professional section of the industry; its aim now was to represent the electrical industry as a whole, which accounted for its policy of decentralisation. The various territorial centres scattered over the country were doing very valuable work. The desirability of registering all qualified engineers was admitted, but he was told that it took the medical profession 20 years to carry its registration through. The present difficulty was to settle upon an adequate definition of a civil or any other engineer.

The "Future of British Industries" was proposed by Mr. G. Midgley Taylor, who gave it as his opinion that the future prosperity of industries in this country depended on cheap power, and in this connection he hoped that the schemes proposed by Sir John Snell, who was present, and his Commission would be brought to early fruition. Further, the water powers of this country should not be neglected; although they were not so abundant as those to be found in other countries, still they were of sufficient importance to render useful aid. He had no fear for the future of British industries. One thing did trouble him, however, and that was labour. He did wish that they could by some means or other rouse the working man's sense of responsibility, to make him endeavour to do an honest day's work.

The toast was responded to by Viscount Cowdray, P.C., President of the Federation of Civil Engineering Contractors, who dealt with the financial side of the matter, and said in part that the present state of affairs with regard to labour was due to the lack of decisive action on the part of the Government in dealing with wages and claims put forward. Labour could not be dealt with in sections, it could only be considered as a whole. When they sought information or advice on technical engineering questions they need go no further than this country, but when it came to business matters they had to go, he was sorry to say, to the U.S.A. It was very wasteful to burn oil under boilers; it should be reserved for internal-combustion engines. The oil existing within the British Empire, in his opinion, should be kept for use within the Empire.

Mr. Ll. B. Atkinson, secretary of the Cable Makers' Association, and president-elect I.E.E., did not think the prospect before them was so rosy as was thought by some; it was time they paused to consider to what they were heading. He need not emphasise the dangers that attended constantly increasing wages and their attendant evils. They were suffering from lack of production, the reason for which was the fear of unemployment on the part of the workers. That was the first problem they must solve, and in his opinion the only way of doing so was by each particular industry guaranteeing the employment of a full complement of operatives in lean as well as in prosperous times. To do that co-operation was essential between factories so that work could be distributed evenly over the whole, and also co-operation in selling the finished products abroad. The next problem they had to solve was that of standardisation, and what they were in need of was co-operative effort. He asked consulting engineers to give their assistance in solving those problems; there was just as much skill required to select the necessary plant for a particular job from standardised as from unstandardised material, and they would need their help to break the economic front, which must be broken if the future of British industries was to be assured.

Mr. Sidney R. Lowcock proposed "Our Guests." Sir F. J. Willis, assistant secretary, Ministry of Health, and Mr. Arthur J. Lees, secretary, Urban District Councils' Association, responded, and the final toast of the evening, that of "Our Hon. Officers," was proposed by Mr. H. W. Couzens, and responded to by Messrs. A. H. Dykes, hon. secretary, and F. E. Wright, hon. solicitor to the Association.

Service Notes.—On return from Constantinople, Mr. T. S. Harvey, acting assistant electrical engineer, has been posted to Devonport Dockyard. Lieut. H. C. Crossley, Cinque Ports Fortress Engineers (Electric Lights Company), has resigned his commission after four years' service, and has been granted the rank of captain. Lieut. H. F. Hecking, Lancashire Fortress Engineers (Electric Lights Company), has resigned his commission. He served in the corps from 1916. Lieut. G. V. Waterhouse has resigned his commission in the Electric Lights Company of the Fortress Engineers (Territorial Force). A large number of wireless operators, some 150, are wanted for the army, as well as a lot of electricians (wireless) fitters, and instrument makers for the Army Signal Service. The service is competing against private firms by offering a bounty of £100 to wireless operators and £50 to the others.

Kinema Operators' Strike.—A number of kinema operators are on strike in Manchester and Salford for a wage of from £3 10s. to £4 10s. a week according to the size of the hall, locality, and charge for admission. The Electrical Trades Union has declared the strike, and the men's officials state that over 80 per cent. of the proprietors have met the demands in full. To these permits to perform have been granted. The remaining kinemas are being picketed.

The Women's Engineering Society.—At the first annual general meeting of the Society, which was incorporated this year, the Hon. Lady Parsons presided, and said, in the course of an address, that in order to gain their objects they must exercise patience and continue their struggle. Miss Rachel M. Parsons was elected president, Miss Selby hon. secretary, and Lady Parsons treasurer, with a strong Council. The annual report stated that the work of the Society was meeting with success. A small quarterly, entitled "The Woman Engineer," had been established, and a club-room opened at 46, Dover Street, W. A resolution deprecating the continued exclusion of women from training and employment in many industries, and calling upon all leaders of industry and Trade Unions to unite with them in overcoming all artificial barriers to progress, was carried, and a discussion took place on "The Present Position of Women in the Various Branches of Engineering."

Appointments Vacant.—Mains engineer (£6), for the Greenock Corporation Electricity Department; switchboard attendant (92s. 3d.), for Rawtenstall Corporation Electricity Works; lecturer in mathematics (£315), assistant lecturers in mechanical or electrical engineering (£275 or £315), for the Woolwich Polytechnic; mains assistant, for the Colombo Electric Tramways and Lighting Co., Ltd.; second assistant superintendent, for Central Canal Works, Amritsar, Punjab (Rs. 725 to 1,025 per month); charge engineer (£270), for the Bootle Corporation Electricity Works; meter superintendent (£5 5s.), for the Paisley Corporation Electricity Department; E.H.T. plumber-jointer (£5), for the Swansea B.C. Electricity Department; junior for the mains department (84s.), for the Bradford Corporation Electricity and Tramways Department; engineering draughtsman (£200 + 20% + £120), for the Hammersmith B.C. Electricity Department. See our advertisement pages to-day.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The Secretary of the Institution announces that applications for the following scholarships may be sent to the Secretary, R.E. War Benefits Committee, R.E. Institute, Chatham:—"A" Scholarships of £40 per annum for children of officers and other ranks of the Royal Engineers of all branches who, prior to the war, were in a position to give their children a public school education. Ten of these scholarships, tenable between the ages of 10 and 18, are available. "B" Scholarships of £15 per annum for children of warrant officers, N.C.O.'s and men, to assist in educating them at a technical or secondary school. Tenable between the ages of 13 and 16 years—40 available. "C" Kitchener Scholarships, at present limited to one of £40 and two of £15, under the same conditions as "A" and "B" respectively. Owing to the large number of casualties, these scholarships will be confined, for the present, to children or dependents of members of the Corps killed in action, &c., or permanently disabled, and in all cases primary consideration will be given to cases of necessity. The applications to be considered in the first adjudication were to be sent in by June 1st, and the necessary forms are obtainable from the Secretary of the R.E. War Benefits Committee.

WIRELESS SECTIONAL MEETING.—On Wednesday, June 23rd, at 6 p.m., at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W., a paper will be read by Mr. B. S. Gossling on "The Development of Thermionic Valves for Naval Uses."

Liverpool Wireless Association.—The usual semi-monthly meeting was held at 56, Whitechapel, Liverpool, on May 26th, when the subject under review was the "Winding of Inductances" and 'Loose Couplers." Numerous methods of construction were discussed, and varying experiences under numerous conditions related. A member also exhibited a piece of apparatus for winding honeycomb coils.

Incorporated Municipal Electrical Association.—Engineers or others who are specially interested in the subjects of papers to be read at the forthcoming I.M.E.A. Bradford Convention, and who wish to be present to speak thereon, should communicate with the Secretary, I.M.E.A., Electricity Works, Factory Lane, Croydon.

Association of Consulting Engineers.—The annual general meeting was held on May 28th, Mr. H. J. Rofe presiding. Moving the adoption of the report of the committee for the past year, the chairman said a sub-committee had been engaged in drawing up a model general set of conditions for use in work carried out on a prime cost and profit basis, a method of carrying out work which had become more and more general. Another matter that had called for attention was the formation of the Federation of Civil Engineering Contractors by the leading firms in the country; they were asking for an over-riding clause to be inserted in all engineering contracts, which in its present form the Association could not accept. As far back as 1914, the Committee had had under consideration a model set of general conditions of contract for electrical work, drawn up by the Institution of Electrical Engineers, to several clauses of which the Committee took exception. The matter had been in abeyance since the beginning of 1915, but the whole question had now been re-opened. The Institution was revising the model general conditions, and had invited the Association to send a representative to sit on a committee formed of all the various interests connected with electrical work. The manufacturers had agreed to modify practically every clause to which the Association raised objections, and he thought that eventually the Electrical Conditions of Contract would come into line with the general conditions that were inserted in their civil engineering contracts. The Council of the Institution of Civil Engineers suggested that the rise in the cost of work automatically increased the engineer's remuneration to the extent necessary to meet his increased expenses, but that in certain cases he was justified in charging an extra fee; in respect of reports, inquiries, Parliamentary work, and general advice on engineering matters, the Council was of opinion that civil engineers were justified in making an advance of 50 per cent. on pre-war rates. These views supported the action recently taken by the Committee of the Association.

During the year the British Engineering Standards Association had asked the Association to appoint representatives on various Sub-Committees.

The Foreign Office and the Board of Trade had recently written to the Association suggesting that members who were going abroad should give notice to the Department of Overseas Trade of their intention, so that the Department could notify H.M. Diplomatic Consular and other officers concerned, and give them the opportunity of rendering assistance and of discussing matters connected with British trade of very great interest to them. This, he thought, was a very valuable suggestion. The report was carried unanimously.

The accounts for the year showed a balance of income over expenditure of £24.

The ballot for new members of the Committee resulted as follows:—

London Members.—Messrs. Kenneth P. Hawksley, W. Vaux Graham, A. M. Sillar, H. R. J. Buratall, and John H. Rider.

Country Members.—Messrs. James Caldwell and F. W. Hodson.

Votes of thanks were accorded to the honorary solicitor, Mr. F. E. Wright; to Messrs. Cash, Stone & Co., the honorary auditors; to Mr. H. J. Rofe for acting as chairman; and to the honorary secretary (Mr. A. H. Dykes) and the honorary treasurer (Mr. S. R. Lowcock) for their valuable services during the past year.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. STEVENSON, telegraph and electrical engineer to the Caledonian Railway Co., Glasgow, on the occasion of his retirement on reaching the age limit, was waited upon on Friday by his office staff and a few friends and presented with a gold watch for himself, and a diamond ring for Mrs. Stevenson. The presentation was made by Mr. A. S. Humpton, his successor in office.

The King has granted permission for MR. C. D. LEYS, electrical engineer, Malta Dockyard, to wear the Japanese Order of the Rising Sun (Fourth Class), conferred upon him in recognition of valuable services.

MR. E. H. W. COOKE, who was chief accountant with the Birmingham Corporation Gas Department for many years, and has been appointed chief accountant with the Metropolitan-Vickers Electrical Co., Manchester, bade farewell to the Gas Committee on Monday.

Leek (Staffordshire) Urban District Council has decided to increase the salary of the electrical engineer to £400 per annum.

Horsham Urban District Council has increased the salary of the assistant engineer at the electric lighting works from £220 to £250 a year.

MR. F. HARMAN LEWIS, chief electrical engineer to the Leyton Urban District Council, on completing 21 years' service, has been presented by the staff and employés with a clock with Westminster tubular chimes.

MR. A. W. J. BEDBROOK has resigned his position as managing director of the C.E.A., Ltd. His address is 140, Delaware Mansions, Maida Vale, W.

Messrs. Robinson & Hands Electrical Co., Ltd., of Birmingham, have just engaged MR. S. GRAY, late of Messrs. J. H. Tucker & Co., Ltd., to take complete charge of their case-making department for the manufacture of fuseboard cases and general electrical woodwork.

The honour of O.B.E. has been conferred upon CAPTAIN JOHN WILSON, chief electrical engineer, Buenos Aires Western Railway, superintending engineer of the Shandon Experimental Station. CAPTAIN THEODORE WILLIAM SMYTHE, Master of the Eastern Telegraph Co.'s cable ship *Electra*, has received a similar distinction. MR. P. F. JOHNSON, late Chief Officer of Messrs. Siemens's cable ship *Faraday*, is made M.B.E.

Obituary.—MR. J. FINDLAY.—The death is announced of Mr. James Findlay, for many years managing director of the Rugby Lamp Co., Ltd., whose premises were taken over by the B.T.H. Co., Ltd.

MAJOR S. C. A. WACE.—The death is announced to have taken place at Hampstead of Major S. C. A. Wace, C.B.E., Royal Marine Artillery, head of the Wireless Telegraphy Board. He was in charge of the wireless station at Malat during the war, and was the author of a hand-book on "Wireless Telegraphy."

NEW COMPANIES REGISTERED.

Anglo-Russian Engineering Co. (Birmingham), Ltd. (167,458).—Private company. Registered May 14th. Capital, £1,000 in 5s. shares. To carry on the business of electricians, mechanical engineers, suppliers of electricity, manufacturers of and dealers in electrical apparatus, &c. The subscribers (each with one share) are: J. B. Webb, 1, Telford Avenue, Streatham, S.W. (managing director, Anglo-Russian Engineering Co., Ltd.); J. Hastings, Lee Mount, Yardley Wood Road, Moseley, Birmingham, accountant; V. E. Whalley, Alyon, Dora Road, Small Heath, Birmingham, engineer. The subscribers are to appoint the first directors. Secretary: J. Hastings. Registered office: 26, Guildhall Buildings, Stephenson Street, Birmingham.

Wilkins Wire and Wire Ropes, Ltd. (167,584).—Private company. Registered May 18th. Capital, £125,000 in £1 shares. To take over the undertaking, assets and liabilities of the Wilkins Wire Rope Co., Ltd. (incorporated in 1904), and to carry on the business of wire and wire rope manufacturers, manufacturers of and dealers in mining, colliery and electrical machinery, electrical, mechanical, hydraulic, heating and ventilating engineers, &c. The subscribers (each with one share) are: Elsie L. Trollope, 28, Crossways, Stoke Newington, N.16; A. J. Taylor, 28, Duncombe Road, Hornsey Rise, N.19, clerk. The first directors are: S. H. Hudson (chairman and permanent director), T. H. Hudson, General W. Wright Bemrose and A. S. Watson. Secretary: W. E. Bowley. Solicitor: H. Clifton, 4, New Court, Lincoln's Inn, W.C.

Catchpole & Maurice, Ltd. (167,513).—Private company. Registered May 17th. Capital, £5,000 in £1 shares. To take over the business of wholesale and export electrical and mechanical engineers and merchants formerly carried on by A. E. Catchpole and E. Maurice at Albion House, New Oxford Street, W.C. The first directors are: A. E. Catchpole, 17, Broxholm Road, S.E.27; C. B. Maurice, Russell Square Mansions, W.C.; F. W. Dennis, 15, Ventnor Villas, Hove; W. N. Scovell, 41, Lee Park, Blackheath. Solicitor: A. G. Hardy, 27, Chancery Lane, W.C. Registered office: Albion House, 59-61, New Oxford Street, W.

McReynolds Trolley Wheel Co., Ltd. (167,495).—Private company. Registered May 15th. Capital, £5,000 in 5s. shares. To carry on the business indicated by the title, and that of electric, railway, tramway, naval, marine and general engineers, &c. The subscribers (each with one share) are: E. M. Lloyd, 143, Mount View Road, Stroud Green, N.4, secretary; A. E. Hutton, 55, Kimberley Road, Stockwell, S.W.9, secretary. The subscribers are to appoint the first directors. Solicitors: Roney & Co., 42, New Broad Street, E.C. Registered office: 11, Angel Court, E.C.

Dux Electric Quilt & Fibril, Ltd. (167,727).—Private company. Registered May 28th. Capital, £10,000 in £1 shares. To take over the business of mattress manufacturers, engineers and agents carried on by W. Fairclough, H. Speakman, T. R. Greenough and R. E. Beddoe as "Hall and Co." and "Fibril and Co.," together with certain British and Colonial patents for improvements in the manufacture of horsehair, devices for fastening or securing ropes, rope handles, cords and the like, and improvements in electric heating quilts, blankets and the like. The first directors are: H. Speakman, The Walmsleys, Leigh Road, Leigh, Lancs.; T. R. Greenough, Beachwood, Leigh Road, Leigh, Lancs.; E. C. Beddoe, Tower Buildings, Wallgate, Wigan; E. R. Davies, 3, King Street, Wigan; G. A. Kirk, Electrical Works, Wilcock Street, Wigan; P. Gaskell, jun., 112, Park Road, Hindley. Registered office: Dobb's Fold, Wallgate, Wigan.

Telephone Manufacturing Co. (1920), Ltd. (167,634).—Registered May 20th. Capital, £900,000 in £1 shares. To take over the business of the Telephone Manufacturing Co., Ltd., and to carry on so far as is lawful the business of makers, sellers, hirers out, maintainers and workers of and dealers in telephones and telegraphs, &c. The first directors are: F. T. Jackson, 20, Herne Hill, S.E.; C. Cochran, 58, Newark Drive, Pollokshields, Glasgow; J. MacMahon, Sheriff Park House, Ruthergien, N.B. (all directors of London Telephone (N.S.) Co., Ltd, and other companies); T. H. Walker, 7, Linden Gardens, W.; C. E. Walker, 43, Clifton Hill, Maida Vale, W.; C. Clare, 32, Eaton Terrace, S.W. (managing director, George Clare & Co., Ltd., &c.). Minimum cash subscription, 7 shares. Solicitors: Durrant, Cooper and Hambling, 70-71, Gracechurch Street, E.C. Registered office: Hollingsworth Works, Martell Road, West Dulwich, S.E.

H. & F. Moore, Ltd. (167,649).—Private company. Registered May 21st. Capital, £2,000 in £1 shares. To carry on the business of machine builders, electricians, electrical, mechanical, motor, telephone and general engineers, &c., and to adopt an agreement with H. Moore. The subscribers (each with one share) are: Mrs. C. Stanton, Albert Road, Hinckley; B. Gill, 49, Winchester Avenue, Leicester. Mrs. C. Stanton is first director. Secretary: F. E. Fordham, 19, Cank Street, Leicester. Registered office: Albert Mill, Hinckley, Leicestershire.

National Electric Welding Co., Ltd. (167,631).—Private company. Registered May 20th. Capital, £10,000 in £1 shares (4,000 preference). To carry on the business indicated by the title. The first directors are: F. E. Saunders, 63, Leigham Court Road, Streatham, S.W.; P. Buckley, New Oxford and Cambridge Club, 68, Pall Mall, S.W.; N. D. R. Bruce, Blythswood, 63, Leigham Court Road, Streatham, S.W.; H. C. Wright, Wychwood, Arlington Drive, Mapperley Park, Nottingham. Solicitor: W. H. Bellamy, Walter House, 418-422, Strand, W.C. Registered office: 6, Old Queen Street, Westminster.

Taggart & Wilson, Ltd. (11,252).—Private company. Registered in Edinburgh May 20th. Capital, £6,000 in £1 shares. To carry on the business of general merchants, electricians, mechanical, electrical, gas, structural, water and general engineers, ironmongers, builders, &c. The subscribers (each with one share) are: R. Taggart, Arcadia, Cathcart Street, Motherwell, builder; J. Wilson, Anwoth, Douglas Street, Motherwell, electrical engineer; J. Taggart, Coradinn, Catherine Street, Motherwell, motor engineer; T. Taggart, Kilnkoln, Catherine Street, Motherwell, motor engineer. The first directors are not named. Secretary: R. T. Ballantyne, 2, Windmillhill Street, Motherwell.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

International Electric Co., Ltd.—Mortgage debenture charged on freehold land, factory and premises at Tottenham and company's general assets, including uncalled capital, dated May 6th, 1920, to secure all moneys due or to become due from company to Williams Deacons Banks, Ltd. Also satisfaction in full on May 5th, 1920 (*a*) of charge dated January 21st, 1919, securing £25,500; (*b*) of mortgage dated February 8th, 1917, securing the sum then due or to become due.

Edmundson's Electricity Corporation, Ltd.—Particulars of £100,000 prior lien debenture stock authorised January 15th, and covered by trust deed of January 13th, 1920; whole amount issued, charged on mortgage debentures in various companies and company's general assets. Trustees: British Trust Association, Ltd.

Lamplough Radiator and Engineering Co., Ltd.—Satisfaction in full on April 30th, 1920 (*a*) of mortgage or charge as collateral security dated September 8th, 1916, securing £12,000, and (*b*) mortgage or charge, dated May 16th, 1917, securing overdraft and general indebtedness.

Siemens Brothers Dynamo Works, Ltd.—Satisfaction in full on May 6th, 1920, of trust deed dated June 10th, 1907, securing £200,000 debentures.

James Keith & Blackman Co., Ltd.—Satisfaction in full of debentures dated October 29th, 1901, July 21st, 1913, and May 11th, 1915, securing £1,300.

National Telewriter Co., Ltd.—Issue on May 12th, 1920, of £130 debentures, part of a series.

Smale & Collins, Ltd.—Particulars of £2,473 debentures authorised April 26th, 1920, whole amount issued; charged on the company's undertaking and property, present and future, including uncalled capital subject to prior charges. No trustees.

Edmundson's Electricity Corporation, Ltd.—Particulars of £75,000 three-year notes authorised January 15th, and covered by trust deed dated April 13th, 1920, whole amount issued; charged on £100,000 prior lien debenture stock. Trustees: British Trusts Association, Ltd.

Herne Bay Gas and Electricity Co., Ltd.—Issue on May 6th, 1920, of £2,000 debentures, part of a series.

Surrey Electrical Co., Ltd.—Satisfaction in full on May 7th, 1920, of debentures dated June 12th, 1919, securing £1,000.

CITY NOTES.

Richardsons, Westgarth and Co., Ltd.

In the course of his speech at the annual meeting, held at West Hartlepool, on Monday, Mr. D. B. Morison said that a dividend of 18 per cent. had already been paid, and a further dividend of 12 per cent. was now due for payment, making 30 per cent. for the year. During the whole of last year only three months were unaffected by labour troubles either in their own works or in the shipyards to which they supplied machinery. Referring to the heavy demands of the Inland Revenue, the speaker said that as provision for efficient production was imperative, there was good reason why sufficient money should be left to them by the Inland Revenue to make good the destructive effects on their plant due to the highly abnormal conditions of working which prevailed throughout the war period. It was not a question of the relative money values of this or that machine before and after the war. The present inflation was simply a passing phase; what they as manufacturers had a right to expect was that the productive efficiency of their plant should be adequately restored. Efficient production was vital to manufacturing success, and, if that efficiency had to remain seriously impaired because of the ravages of taxation, then their manufacturing position would be prejudiced to an extent that could only be revealed, all too late, when they were brought face to face with competition that they might be unable to withstand. With regard to the outlook, they had a very full order book, but, on the other hand, the rate of production was deplorably low. Before the war the standard week was 53 hours, and after making allowance for overtime on the one hand and sickness on the other, the average hours actually worked per man per week were approximately 53. Now, when the standard week was 47 hours, after making allowance for overtime and sickness, the average hours actually worked per man per week was 44. There was thus a net decrease in time worked of nine hours per week per man—or about 17 per cent. Furthermore, and what was worse, the actual time now taken to complete a given amount of work was, on an average, nearly half as long again as before the war. In a business in which a vast amount of highly expensive machinery was employed the effect of such a decrease in its productive capacity as these facts and figures indicated, combined with the corresponding increase in working expenses per unit of work, must obviously be serious. Fortunately there was indications of an appreciation of the undoubted fact that the costs of production were now so extravagantly high that, if the continuous demands for still higher wages were persisted in, commercial success would ultimately become impossible. Demand would then cease, and a slump—and unemployment—must inevitably follow. The desideratum at the moment was the restoration of at least the pre-war output per man per hour.

Calcutta Electric Supply Corporation, Ltd.

At the annual meeting, held on May 27th, the chairman said that the coal position in India was now easier, and they had been able to place new contracts, but the cost per ton had considerably increased. The increased cost of generation and distribution was referred to. Excess profits duty at £61,794 showed an increase of £29,794. The assessments for excess profits duty in respect of the years 1917 and 1918 which had now been received, showed £27,724 over and above the amount reserved for this purpose in the 1918 accounts, and this sum added to the £34,070 reserved in respect of 1919 made the total £61,794. He now placed before the meeting the scheme for a retiring gratuity fund for the staff, which was sanctioned in 1917. They had reverted to the pre-war system of a bonus to employés based on net profits. This bonus had been fixed at 2 per cent. on the 1919 net profits, and amounted to £4,884. The further reduction to a general 3 annas flat rate was put into force from March 1st, 1920. Considering that so many electric supply undertakings had raised their rates, their customers had every reason to be

satisfied with the reduction as regards the cost of their lighting and fans. To the company it was a costly reduction, but they looked for increased demands for current at the very low rates now charged. After referring to the proposed bonus share distribution, for which they were capitalising £55,000 of the reserve fund, the speaker discussed the excess profits duty and the new corporation tax. He said it was to be hoped that before long some means would be found to obtain the necessary State revenue by a method which would bear less hardly on those companies whose datum level was a low one. In the case of this company, the increase of profits since 1914 had in no way been due to the war, but to the large increase in business due to capital expenditure shortly before 1914. Apart from the onus of taxation, the prospects were decidedly bright. After five years of stagnation during the war, there were signs of great activity in business in Calcutta, and a corresponding demand for electric power. Mr. Donkin, consulting engineer, visited Calcutta last winter, and he had reported as to the best way of arranging a programme to meet the situation. He recommended a very large and costly extension. Notwithstanding that electric plant now cost just about double what it did before the war, they had decided to order two 15,000-KW. turbo-alternator sets with all accessories, for delivery towards the end of next year. That order, large as it was, was justified, nay, necessitated, by the actual applications for current which had been so far received. In addition, very large extensions of the general system were in hand, including new sub-stations and new cables. The total cost incurred, or about to be incurred, was well over one million sterling. Application had been made for an extension of the already large area of the company's supply, and arrangements were being made for spanning the Hooghley at Cossipore, to enable the new demands of districts on the opposite side of the river to be met. The new expenditure would involve more capital, and they wanted to increase the capital from 1¼ to 3 millions, part of which would be required at an early date. They expected to be able to arrange easy terms of payment. In the extensions alluded to no mention was made of such projects as the electrification of suburban railways, and the introduction of tube railways, because although the subject was under discussion, there was, so far, nothing definite to go upon. There were immense possibilities in Calcutta as regarded the demands for electric power, and at no very distant date they might have to come again for still further increase of capital. The chairman briefly referred to the Indian exchange, and spoke highly of the work of the staff in Calcutta contributing to a very successful year in 1919. Mr. Winkfield, the agent and engineer in Calcutta, had retired after 15 years' service, and Mr. J. T. Mertens, for many years deputy agent, had been appointed in his place.

An extraordinary general meeting followed, at which the resolution was passed altering the articles so as to raise the preference dividend rate on the old shares from 5 per cent. to 6¼ per cent., raising new capital, &c.

Brisbane Electric Tramways Investment Co., Ltd.

Mr. H. R. Beeton, presiding at the annual meeting, on May 27th, said that the present position as compared with the previous year was that whilst the operating expenses in Brisbane had increased by £30,830, the receipts in Brisbane had increased by £34,220, but British and Colonial income tax had increased by £17,689, and in 1918 a refund was received of £11,414 on account of excess profits duty, whereas last year only £3,486 was received on the same account. There had been increases of wages since October, 1918, of between 12 and 16 per cent., and 10 and 16 per cent. of the total receipts in Brisbane of £468,892, the amount paid in wages on operation account was £209,000. The speaker gave figures showing the growth of the undertaking, and said he believed that they were the only company in the Commonwealth which had not raised its fares. Mr. Badger had felt it necessary, owing to failing health, to tender his resignation, and had left Brisbane. They were keeping his resignation in abeyance, and were constantly getting the benefit of his advice by correspondence. In the extraordinary circumstances prevailing they had appointed a local board. The speaker proceeded to outline the main features of the Purchase Act passed by the State of Queensland for the purchase of the company's undertaking. Most of the electric light business had already been sold. A special resolution was passed recording deep gratitude to Mr. Badger for his long and conspicuous services to the company, and expressing hope for his speedy recovery.

Madras Electric Supply Corporation, Ltd.

Mr. James Gray, presiding at the annual meeting, on May 28th, said that almost every branch of the business had developed during 1919. The chief trouble was to procure plant and materials to connect new consumers. Additional distributing plant was now necessary, and until this was obtainable early next year the engineering staff would be considerably taxed to meet demands. The revenue from lighting and fans increased by £11,262, due, principally, to the ordinary expansion of business, but to some extent also to an increase of An. 1 in the flat rate, which came into force on August 1st, and would operate for a period of three years. The revenue from power increased by the comparatively small sum of £542, but this was entirely accounted for by a reduction in demand for the tramways in consequence of a strike in the spring of last year, which lasted over three weeks. The total revenue showed an improvement of £22,452 on that of 1918. On the debit side of the revenue account there was an increase under every heading, in consequence of the larger volume of business and of the upward trend in wages and cost of materials. The aggregate was £4,469 more than last year. The net revenue account was enhanced by £4,581, the dividend from their holding in the tramway company. The provision for depreciation and renewals had been increased from £9,000 to £14,000, which some might consider excessive. Having regard however, to the greatly enhanced cost of renewals, which might continue for some years, and to the ordinary depreciation of electrical apparatus which prevailed in Madras in consequence of the atmospheric conditions, it was in the best interests of the company to make liberal contributions until a substantial fund had been built up. After referring to the exchange adjustment account, the chairman mentioned the proposed further extensions of mains. They had on order four 250-KW. rotary converters and one water-tube boiler of a similar capacity to those now installed, and it was hoped shipment would be made about the end of the year. Additional mains would be available about the same time. They also contemplated ordering one 3,000-KW. turbo alternator. In consequence of the steady growth of the demand, they had practically no spares when one unit of the plant was shut down for overhauling, and to remedy this and to provide for new business an additional turbo alternator was necessary, but shipment could not be expected in less than 12 months. The cost of carrying out this programme would be approximately £60,000 to £70,000. In view of the improved prospects the directors decided to postpone the issue of new shares until the results for 1919 had been ascertained. Advantage would be taken of a favourable opportunity of placing new capital, and, meantime, temporary arrangements had been made for their requirements. The tramways company again yielded a dividend of 8 per cent., free of income tax. The traffic receipts increased 9 per cent., but expenditure in Madras rose 19.6 per cent., due to higher wages and increased cost of materials. However, the net revenue was sufficient to pay the usual dividend, to make proper provision for depreciation and renewals, and to provide £1,000 for an employés' gratuity fund, also £3,000 for general reserve. Further labour troubles have been experienced in Madras from which the tramways had not been exempt, another strike having occurred on January 26th last, and continued until February 4th. It having been demonstrated that the cost of living had risen in greater ratio than wages, further increases and allowances were made in addition to the voluntary increases which had been granted by both of their companies. Application had been made to Government, however, for sanction to increase the statutory fares, which were framed 28 years ago, when the spending value of the rupee was much greater than at present.

Dutch Companies.

The N.V. Electrotechnische Artikelen (late John Wolff & Co.), of Gouda, has resolved to pay a dividend of 12 per cent. for 1919 out of net profits amounting to 60,000 florins.

The N.V. Nederlandsche Kabel Fabriek, of the Hague, has declared a dividend at the rate of 34 per cent. out of net profits of 707,000 florins in 1919, as compared with 28 per cent. and 582,000 florins respectively in the preceding year.

The N.V. Metaaldraad Lampenfabriek Volt, of Tilburg, has decided to pay a dividend at the rate of 6 per cent. on the cumulative preference shares for 1919. As the company is entering on a community of interests with another undertaking the balance of the net profits for last year, instead of being applied to the payment of a dividend on the ordinary shares, is being devoted to the redemption of the profit participating certificates.

The report for 1919 of *L. Zelander's Electrotechnische en Technische Handels Vennootschap, of Amsterdam,* states that the home demand for materials and motors was not so great as in the previous years, and prices declined, whilst falling exchange rendered it difficult to export at remunerative prices. The net profits permit of the payment of a dividend of 7 per cent. on the ordinary shares, this rate contrasting with 11 per cent. in 1918.

Italian Companies.

The report of the *Società Generale italiana di Elettricita Edison (of Milan)*—the largest Italian electrical company—with a capital of 96,000,000 lire, of which 74,400,000 lire are paid up, gives an exhaustive exposition of the difficulties with which the Italian industry has at present to contend. Reference is made to the scarcity and incredible dearness of materials, daily increasing delay in the execution of work by contractors, disorganisation of transport, continuous increase in the cost, and the demands of workmen. These causes, the report says, constitute a powerful brake on the construction of new plant, with, in consequence, grave shortage in the amount of electrical energy available, to the pitch of sapping the industrial energies of the country. Allusion is then made to the efforts put forth by the Government to help the electrical industry, and the 40 lire per H.P. subvention is characterised as absolutely laughable; with the present cost of materials, it amounts to no more than 5 per cent. of the prime cost. The tariff rises authorised are also regarded as absolutely inadequate in view of the greater cost of working. The report calls for a revision of all these decrees, which should

be made more in harmony with existing economic conditions. An acute examination is also given of questions of capital and labour, the evils of workmen's organisations and their fallacious pretensions being thrown into relief. The balance sheet showed a net profit of 9,746,289 lire, allowing of dividends of 34 lire to the old shares to bearer, 34,568 lire among other shares, and 12,766 lire to shares issued during the present year, 107,345 lire being carried to the reserve.

Of similar gloomy tenor are the reports of other companies, and noteworthily those of the Società Industrie telefoniche italiane Diglio (Milan), which, on its 6,000,000 lire capital, was unable to declare a dividend, its net profits being only 80,447 lire. Workmen's agitations and the low output of the labourer are the reasons given. The Officine Elettroferroviarie (Milan), with 8,000,000 lire capital, was only able to distribute 9 lire on its 100 lire shares, the cause alleged being the plight in which the whole manufacturing industry lay, in consequence of reduced production and the agitations of workmen. The Società Anonima Ing. V. Tedeschi (Turin), while distributing 12 lire on its 100 lire shares, also lays strong emphasis on the difficulties of all kinds besetting the working, especially those of labour, which, it says, is becoming daily dearer, and more undisciplined, new taxes, rising exchange, &c.

Electric Construction Co., Ltd.—The net profit for the year ended March 31st, 1920, after providing £6,304 for debenture interest and £10,000 for depreciation is £66,169, plus £38,669 brought forward, less £20,000 paid on account of excess profits duty for the year ended March, 1919, making £84,839. After paying 7 per cent. on the preference shares and 7½ per cent. for the year on the ordinary, both less tax, a bonus of 2½ per cent. is to be paid on the ordinary, leaving £10,663 carried to general reserve (making it £100,000), and £39,781 to be carried forward, subject to liability for excess profits duty. The extensions of the works were only completed in time to permit of their contributing in a small degree to the profits of the past year. The moulders' strike, which lasted for 18 weeks, caused great disorganisation, which will continue to be felt during the new financial year. The enlarged premises, however, will permit of an increased turnover, and the volume of unexecuted orders exceeds that of any previous period.

Peel-Conner Telephone Works, Ltd.—The profit and loss account shows a net profit for the year ended March 31st, 1920, of £31,595. Of this, £10,000 has been put to general reserve and £5,000 to depreciation reserve. £16,595 remains, plus £8,560 brought forward. After paying the preference dividend, a dividend of 2s. per share, free of tax, and a bonus of 1s. per share, free of tax, are to be paid on the ordinary shares, leaving £8,155 to be carried forward. The works have been fully employed during the year. The great amount of orders in hand, as well as the growing demand for telephone equipment throughout the world, necessitates a considerable extension of the works. A site has been acquired near Coventry; factory buildings are in course of erection, and a quantity of plant has already been secured. The necessary funds for these extensions are being provided by the General Electric Co., Ltd.

Austin Motor Co., Ltd.—After paying preference dividends for 1919, a bonus of one ordinary share is given for every two ordinary shares held, and there is carried to general reserve £425,000 to provide for liabilities to the Inland Revenue and to leave a substantial proportion available for other contingencies. With the same object it is proposed that the ordinary shareholders should not take any dividend in cash. Sir Reginald H. Brade (late Secretary to the War Office) has joined the board. The accounts for 1916, 1917, and 1918 are also now presented.

Oldham, Ashton & Hyde Electric Tramways Co., Ltd.—Net profit for 1919 £16,529, plus £4,957 brought forward. To reserve £10,000; 6 per cent. dividend on the ordinary shares; carried forward £5,987. The local authorities have given notice of intention to purchase the undertaking, and arbitration proceedings relating to price will begin shortly.

Bordeaux Electric Tramways Co.—The directors of the Compagnie Francaise des Tramways Electriques et Omnibus de Bordeaux announce payment of dividend as follows: 11,875 frs. on registered shares by endorsement on certificate; 10,756 frs. on bearer shares against coupon No. 33; 297.50 frs. for drawn shares, plus an "action de jouissance."—*Financial Times.*

Brisbane Electric Tramways Investment Co., Ltd.—Dividend of 8 per cent. per annum, free of tax, on the ordinary shares for the half-year, making 8 per cent. for the year. £20,000 to reserve, carrying £38,876 forward.

Cork Electric Tramways & Lighting Co., Ltd.—After putting £6,500 to reserve for depreciation and renewals and £4,000 to maintenance reserve, 5 per cent. is paid on the preference shares and £2,512 is carried forward.

Anglo-Argentine Tramways Co., Ltd.—Dividend of 5s. 6d. per share, less tax, on the 5½ per cent. cumulative first preference shares, being 12 months' arrears to June, 1918.

Anderston Foundry Co., Ltd.—Final dividend 15s. per share, making 18s. per share for year ended March, 1920. £10,000 to reserve.

Cork Electric Tramways & Lighting Co., Ltd.—Dividend of 5 per cent. on the cumulative preference shares for 1919.

Canadian General Electric Co., Ltd.—Dividend of 2 per cent. on the common stock for the June quarter.

Brazilian Traction, Light & Power Co., Ltd.—Quarterly dividend of 1¼ per cent. on cumulative preference shares.

STOCKS AND SHARES.

Tuesday Evening.

Interest this week has been taken up a good deal more by sport than by finance. Nevertheless, the latter absorbs a good deal of attention, and the tone in the Stock Exchange markets is a little firmer than it was. This is due to the expectation that the War Profits Levy will be entirely dropped. On the other hand, cautious people aver that the Chancellor will have to get the money somehow, and that as the Treasury 5¾ per cent. 5-15 year bonds have so far proved a fiasco, more drastic taxation will be introduced later. Accordingly, it cannot be said that the clouds of uncertainty are lightened to any great extent. This being so, it is natural enough that investment demand should run mostly upon the gilt-edged stocks which have been in such favour for the past three or four weeks. Once more it is preference shares which command more support than ordinary, while as for good debentures in well-known industrial concerns, such stocks are so scarce as to make their acquisition a matter of speculation as well as investment.

The dulness of electric lighting shares continues to be a matter for some surprise. This does not materialise into buying orders, and consequently the pressure to sell a hundred or two shares in any particular company has a pronounced effect. County of London ordinary can be bought about 8 or a shade over, and at the level price they show a return of 10 per cent. on the money, while the yield on Westminsters, as already indicated here, comes also to the round double figures. Kensingtons are lower at 4¼, Chelseas at 50s. Why this should be so is a matter difficult to explain, but the fact remains, and investors decline to be tempted with the opportunities offered them in this department.

General Electric 6½ per cent. first preference can be bought at 18s. 6d., giving 7 per cent. on the money, and the 7½ per cent. "B" preference at 19s. 6d. return 7¾ per cent. Vickers 5 per cent. preference, tax free up to 6s., are on offer at 19s., returning 5¼ per cent. net, equal to 7½ per cent., less tax. The company's issued capital is six million sterling, and there are reserves of rather over 2½ millions sterling. Armstrong 6½ per cent. new third preference stand at 18s., affording 7¼ per cent. on the money. Another tax-free investment is the "A" preference of Adelaide Electric Supply. The shares can be bought at 19s. 6d., giving 5¾ per cent. on the money net, equal to 7¼ per cent., less tax, and the Lancashire Power Construction 6 per cent. tax free first preference at 19s. 6d. yield 6¼ net, the shares being convertible into ordinary up to June, 1923.

The remarkable traffics published by the London General Omnibus Company of the number of passengers carried in the Whitsun week, together with the forthcoming developments in the way of extending motor-'buses into the country, and on pneumatic tires, strengthens the impression that the Underground Electric 6 per cent. income bonds are by no means over-valued at their present price of 61¼. It is possible enough there may be further reduction in the dividend this half-year, and those who buy the bonds will do so with the intention of putting them away and waiting for better times. Until the company is given power to raise its fares, there is not likely to be much attention paid to the bonds, but as soon as the Undergrounds do get upon a business basis, there will come sharp improvements in the various issues. It is, of course, as a lock-up that the bonds are pointed out as unduly depressed. For income purposes, they hold out little attraction as present.

One of the features of the week is a smart rise in Brazilian Traction Common shares, the price spurting to 54 before any number of shares were dislodged. The price at 53 is 3¼ higher on balance. Talk is reviving of the company being able to resume its one per cent. quarterly dividends in the near future. The last distribution made was in January, 1917, so shareholders have been wandering in the wilderness for 3¼ years without any reward for their patience. The shares having been held largely in Paris and Brussels, recent Continental selling included these amongst other securities which the foreign holders endeavoured to melt into cash for what the shares could fetch. It may be argued that even a resumption of 4 per cent. annual dividends would not make the shares particularly attractive at 53, but here again it must be recognised that in the enormous field open for profitable working in Brazil, as soon as the unfavourable conditions become dissolved, prospects will brighten materially. Meanwhile, dollar securities of Brazil and the United States have been hardening up a little after their fall of a week ago, but prices

are put up and down, more in accordance, of course, with the movements in rates of exchange than with any particular business in the stocks.

Mexican securities are a little better, although the actual alterations are small. Anglo-Argentine Trams keep their improvement. British Columbian deferred is harder at 45½, and the 4½ per cent. debenture gained ½ at 52½.

Amongst telegraphs and cable shares, a fall of 5 has lowered Indo-European to 35. The price has dropped sharply since the announcement of the reduction in dividend. West India and Panama have recovered a trifle after their heavy fall. The first and second preferences, however, remain about £5 per share nominally, the first having last changed hands at 80s. ten days ago. Marconis developed a fair amount of strength, and at 3 5/16 show a gain of 3/16 on the week. Marconi Marines have risen to 2½.

Callenders are now quoted in their £1 shape, instead of £5 as heretofore. The price at 1½ is nominally 10s. lower than it stood at £8 before the splitting. The preference shares at 18s. 9d. are practically the same as they were before the alteration occurred in them also. General Electric ordinary at 32s. are ninepence better. British Insulated have eased off a trifle, and other movements are of little moment. Rubber shares keep tolerably steady, and with the price of the commodity once more over a florin per lb., there is a slight disposition on the part of the public to pick up shares when the latter come in cheaply. The armament group is fairly hard, but in all the sections devoted to industrial shares, the fear of what effect may be produced upon profits by the 60 per cent. E.P.D. is a predominant factor. Rumour still sports with the idea that the increase of 20 per cent. may be dropped, but no particular importance attaches to this improbability.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price June 1, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	8	12	6½	—	£9 8 2
Charing Cross Ordinary	4	7	8¾	—	9 6 8
do. do. do 4½ Pref.	4½	4½	9¾	—	8 8 8
Chelsea	3	4	2½	— ½	8 0 0
City of London	8	10	1¼	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	7	8	8¼	— ¼	9 17 0
do do. 6 per cent. Pref.	6	6	8½	— ¼	7 5 5
Kensington Ordinary	6	7	4¾	— ¼	7 15 6
London Electric	Nil	2½	1½	—	6 0 0
do. do. 6 per cent. Pref.	6	6	8½	—	9 4 8
Metropolitan	8	8	2½	—	10 8 8
do. 4½ per cent. Pref.	4½	4½	2 3/8	—	8 0 0
St. James' and Pall Mall	10	12	6¾	—	8 16 10
South London	5	6	2¾	—	9 12 0
South Metropolitan Pref.	7	7	18/9	—	7 0 0
Westminster Ordinary	8	10	5	—	10 0 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	77½	—	7 14 10
do. Def.	£3/6	1½	18½	—	8 2 2
Chile Telephone	5	6	6½	—	*4 18 2
Cuba Sub. Ord.	7	7	9½	—	*7 7 4
Eastern Extension	8	10	15	—	*6 13 4
Eastern Tel. Ord.	8	10	15¾	—	*6 11 4
Globe Tel. and T. Ord.	8	10	15½	—	*8 7 0
do. do. Pref.	6	6	8½	—	7 1 2
Great Northern Tel.	22	—	21½	—	9 15 6
Indo-European	18	10	35	— 5	7 2 10
Marconi	25		3 5/16	+ 3/16	7 11 6
Oriental Telephone Ord.	10	12	2½	—	*4 16 0
United R. Plate Tel.	8	—	7½	—	*5 6 8
West India and Panama	1/8	—	1/8	— 1/16	—
Western Telegraph	8	10	15½	—	*8 7 0
HOME RAILS.					
Central London Ord. Assented	4	4	44½	—	8 19 9
Metropolitan	1	1½	19½	— ½	6 8 2
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	— ¼	Nil
do. do. "A"	Nil	Nil	4/-	—	Nil
do. do. Income	5	4	60½	—	6 12 3
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams. First Pref.	Nil	Nil	3½	—	—
do. do. 2nd Pref.	—	—	8	—	—
do. do. 5 Deb.	5	5	57 xd	—	8 18 6
Brazil Tractions	—	—	53	+ 3½	—
Bombay Electric Pref.	6	6	13½	—	4 11 3
British Columbia Elec. Ry. Pfce.	5	5	55½	—	9 2 0
do. do. Preferrred	2½	5	48½	—	10 6 2
do. do. Deferred	Nil	3	45½	+1	6 11 10
do. do. Deb.	4½	4½	53½	+ ½	8 2 0
Mexico Trams 5 per cent. Bonds.	Nil	Nil	28½	—	Nil
do. 6 per cent. Bonds.	Nil	Nil	20	—	Nil
Mexican Light Common	Nil	Nil	13½	—	Nil
do. Pref.	Nil	Nil	24½	—	Nil
do. 1st Bonds	Nil	Nil	42½	+1½	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	—	9½	—	*5 4 4
British Aluminium Ord.	10	10	1 7/8	—	9 8 2
British Insulated Ord.	13½	15	1 27/32	+ 3/32	8 2 8
Callenders	25	—	1½	— ½	8 6 8
" 6½ Pref.	6½	6½	18/9	—	6 18 6
Castner Kellner	20	—	4	—	5 0 0
Crompton Ord.	10	—	22/-	+6d.	9 1 10
Edison-Swan, "A"	10	—	1 7/8	—	8 8 0
do. do. 5 per cent. Deb.	5	5	79½	—	6 5 9
Electric Construction	10	—	21/-	—	9 10 6
Gen. Elec. Pref.	6½	6½	18/6	+6d.	7 0 6
do. Ord.	10	—	32/-	+9d.	*6 5 0
Henley	25	15	2	—	7 10 0
do. 4½ Pref.	4½	4½	5½	—	6 18 6
India-Rubber	10	—	13½	—	*7 11 0
Met.-Vickers Pref.	—	8	2 7/8	—	6 18 6
Siemens Ord.	10	10	26/-	—	*7 13 10
Telegraph Con.	20	20	22½	—	*5 6 8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, June 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	2/10	...
a Ammoniac Sal	per ton	£100	...
a Ammonia, Muriate (large crystal)	"	£92	...
a Bisulphide of Carbon	"	...	...
a Borax	"	£42	...
a Copper Sulphate	"	£48	£1 dec.
a Potash, Chlorate	per lb.	1/-	...
a " Perchlorate	"	1/8	...
a Shellac	per cwt.	£29 10s.	£0/- inc.
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	"	£38	...
a " Lump	"	£25	...
a Soda, Chlorate	per lb.	6d.	...
a " Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£118 to £345	
c Brass (rolled metal 2" to 12" basis)	per lb.	1/8	½d. dec.
c " Tubes (solid drawn)	"	1/5½ to 1/6	½d. dec.
c " Wire, basis	"	1/5½	½d. dec.
c Copper Tubes (solid drawn)	"	1/6½	½d. dec.
g " Bars (best selected)	per ton	£161	£4 dec.
g " Sheet	"	£161	£4 dec.
g " Rod	"	£161	£4 dec.
d " (Electrolytic) Bars	"	£109	£5 dec.
d " " Sheets	"	£156	...
d " " Wire Rods	"	£124	£5 dec.
d " " H.C. Wire	per lb.	1/4	½d. dec.
f Ebonite Rod	"	8/-	...
f " Sheet	"	2/6	...
a German Silver Wire	"	3/-	...
h Gutta-percha, fine	"	13/-	...
h India-rubber, Para fine	"	2/11½	1½d. dec.
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l " Wire, galv. No. 8, P.O. qual.	"	£57	...
g Lead, English Pig	"	£40 10s.	...
g Mercury	per bot.	£17 10s. to £18	£3 10s. to £7 dec
a Mica (in original cases) small	per lb.	6d. to 4/6	...
a " " " medium	"	5/- to 10/-	...
a " " " large	"	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings	"	1/6 to 1/1	...
g " " rolled bars and rods	"	2/2 to 2/6	1d. dec.
g " " rolled strip & sheet	"	2/3 to 2/9	...
d Silicium Bronze Wire	per lb.	1/11½	...
r Steel, Magnet, in bars	"	1/8	½d. inc.
g Tin, Block (English)	per ton	£273 to £274	£10 to £11 dec.
n " Wire, Nos. 1 to 16	per lb.	4/9	0d. dec.
White Anti-friction Metals	per ton	£90 to £345	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Licensing Wiremen.—Most of the principal cities in New Zealand have licensed wiremen for some ten years, and have found that the application of the system was necessary in the interests of satisfactory workmanship. When the Victorian scheme was put before the Australian Electricity Commissioners, who had been empowered by Parliament to make the necessary regulations, they eliminated the clause providing for the licensing of the electrical contractor—the employer, as well as the employé. The regulations were passed by the State Executive Council in March, and the rules came into operation on April 1st last, but already efforts are being made to amend them so as to include the rejected clause, which is considered to be vital to the issue, for it is contended that an employer may place the licensed employé in an invidious position by supplying him with material about which he has scruples. The scope of the examinations for licences may include tests in calculation, practical work, sketching, and knowledge of such rules as may be prescribed, and the Commissioners may determine that oral, written, or practical tests shall be employed. No fees will be charged for examinations or for the licence. The Commissioners may grant licences to wiremen holding licences in another State, providing that the Commissioners are satisfied with the system of licensing in that State. Applicants may be exempt who have passed an equivalent examination held by an approved body.

Static Charges on Motor Lorries.—According to *La Feuille*, motor lorries running between Gabès and Tatouine often become charged with electricity during sirocco storms, and when the drivers grasp the starting handle for re-starting after a stop they are liable to receive severe shocks. The phenomenon is ascribed to the discharge of electrically charged particles of sand on to the chassis, the charge being maintained owing to the good insulation of the vehicle from the ground by its rubber tires. The drivers attach trailing wires to the vehicles in order to allow the charge to flow to earth.—*Technical Review.*

WHAT IS THE CONTRACTOR DOING?

[COMMUNICATED.]

Domestic electrification is in a state of arrested development: not technically, for lack of enterprise and inventiveness cannot be charged against the engineer. He has done *his* part, and has designed a wonderful range of highly-efficient appliances for heating, cooking, cleaning—in fact, for every household purpose involving the use of heat or mechanical energy. Supply stations are partly to blame, because many of them have not encouraged, and some have quite definitely discouraged by the imposition of high rates, the non-lighting applications of electricity.

This, of course, is a serious handicap; but undoubtedly the chief responsibility for the suspended animation of the electrical industry rests on the shoulders of the contractor. After all, it is his business to create a demand for electrical appliances, and once the demand is created, everything else must inevitably follow. The attitude of the average contractor seems to be one of hopeless resignation to an unkind and gas-engineered fate. He does not seem to realise his responsibility in the matter; he cannot see that he is the master of his own fate. And yet there is no doubt but that if the retail side of the business would only bestir itself, we might soon look for that happy day when electric boilers shall be as common and unregarded as the gas ring.

What is the contractor doing to advance electrical interests? In ninety-nine cases out of a hundred, the answer is "Nothing." He opens a small shop, fills the window with a miscellaneous collection of uninteresting articles, such as tumbler switches, ceiling roses, &c., with, perhaps, a single flat-iron and a kettle to give an air of modernity to the display. And then he waits for business to come to him. Occasionally he carries out a small wiring job, and, perhaps, supplies the fittings therefor, although frequently the householder has already bought them from a West-End showroom. But he does not, and apparently will not, regard his business premises primarily as a shop where goods are stocked in sufficient quantities and sold over the counter. Ten to one, if you call on any suburban electrical contractor, and ask for any ordinary heating or cooking device, you will be told that it can only be obtained by placing an order in advance. There may be a single piece of apparatus for demonstration purposes, but even that is doubtful. Sometimes bread and butter articles, like lamps and shades and simple fittings, cannot be obtained.

Bad deliveries, small production, and other manufacturing shortcomings may be urged as an excuse, but the excuse is not adequate. Things were just as bad before the war. The trouble is that the ordinary contractor will not place a stock order for anything beyond a few wiring accessories. It is obviously impossible to conduct a successful retail business without a stock; people simply will not buy without seeing. Naturally enough, when a householder does want any piece of electrical apparatus, he goes to one of the big electrical showrooms in the West End or City, or to a department stores, where he can almost be certain of finding the things he desires to purchase. That this procedure should be necessary is a damning indictment against the contractor, and constitutes a serious hindrance to the extension of electrical service.

It would probably improve matters if the manufacturers of cookers, irons, fans, &c., were to advertise their products to the general public. This would create a demand; but, after all, the contractor has no business to rely on the advertising of his suppliers. He should be able to create and supply his own demand.

The first essential of a successful electrical retail business is, therefore, an adequate stock of every sort of domestic appliance. This would naturally involve capital expenditure, but nothing can be done nowadays without capital; and, in any case, an enterprising man should experience no difficulty in raising the necessary money.

Having acquired a stock the question of disposal arises; and it may be taken for granted that, without some form of publicity, electrical appliances cannot be sold. On the other hand, we know from American experience that properly advertised (and any piece of electrical appliance simply bristles with talking points), these things can be sold with the greatest ease, and with a good margin of profit. Electric cookers, cleaners, &c., are necessarily more expensive than their prototypes, and, therefore, although they may tempt, they do not compel the casual customer. When demonstrated, or otherwise advertised, their advantages are so obvious and convincing, that most people will pay any reasonable price to secure such valuable domestic help. They can be made to consider the transaction, not as an unrelated acquisition, but as a productive investment, with regard to which it would be absurd to grudge ha'pennies in first cost.

How is the contractor to advertise his wares? As a rule, Press advertising will not be suitable because the contractor's field is necessarily local, and local papers are not generally read by the kind of people who are most likely to buy. One very effective and cheap method of advertising is by means of window displays. Not the sort of display indulged in by the ordinary contractor, who appears to imagine that passers-by will be cajoled by a dusty and variegated collection of wiring accessories which remains essentially unchanged from season to season and from year to year. The window must be made arresting, attractive, and convincing, and in order to secure these characteristics there must always be a central point of interest, such as a vacuum sweeper, a washer, or a show of fans or irons, which should be fully described by means of legibly-written cards. It is not enough to mark an article, "Washing machine, 100 volts"—that will never sell a thing costing upwards of £40. The window-card should enumerate the chief advantages of the appliance in such a way that he who runs may read, and he who stays will be, if not induced to purchase, at least convinced that by not doing so he is neglecting a duty to his household.

A lot may also be done with the form (or, preferably, the personal) letter. A carefully-written letter, describing a particular piece of apparatus and mentioning others, and asking for an appointment, will almost certainly bring a considerable number of inquiries, of which a good proportion might, by skilful demonstration, be turned into sales. It is the writer's personal opinion that a great deal of business could be done by simply calling on consumers with small appliances and trying to sell them on the spot. This work, of course, would require a man (or woman) of good address and appearance, who knows the talking points from A to Z. There is little doubt but that hundreds of irons, hot-plates, kettles, fans, &c., could be sold in this way to people who might never enter the contractor's shop.

There is a block of moderately expensive flats in a western suburb of London, in which 90 per cent. of the tenants use electric light, but not more than 1 or 2 per cent. use electricity for any other purpose. These people could well afford to buy and use any of the small appliances suitable for lighting circuits, and a pleasant and persuasive salesman who succeeded in interviewing the tenants (and why should he not?) would do excellent business. A demonstration on site is so much more convincing than in a shop, although, of course, every contractor should possess a well-equipped demonstration room.

The fringe of the electrical appliance business has hardly been touched as yet. It is evident that the contractor is the most potent factor in the problem, and that without his intelligent co-operation the most valuable public utility in the world will stay where it is—playing second fiddle to the enterprising mediocrity of coal gas. The contractor must stock and advertise the things he hopes to sell. To expect to sell them in any other way betokens the foolish optimism of the proverb-maker who said that good wine needs no bush. As a matter of fact, it needs the best and most elaborate bush available.

THE FOREMAN IN THE ENGINEERING INDUSTRIES.

By HARTLAND SEYMOUR.

The exact status and responsibilities of the foreman are, just now, receiving a good deal of attention in the engineering industries. Having held the position of a foreman in a machine shop, the writer is naturally exceedingly interested in the various discussions to which he has listened during the past few weeks.

Apparently the foreman in the engineering industries is the "guide, philosopher, and friend" of the shop operative. His business is to represent the management. Among his duties he is primarily responsible for the discipline of his men, finding jobs to suit these men, and seeing to it that they keep to schedule on the work.

The foremost quality of any foreman always has been, is, and always will be, in spite of scientifically-planned schedules, the knack of handling men. Not that this is the only essential quality of a good foreman—he must know his trade thoroughly, besides which, he should possess teaching qualities, in order that he may impart his knowledge to his subordinates.

He should, moreover, be a keen observer of men and methods, so that on one hand he may be able to size a man up and pigeonhole him for a job, and, on the other hand, that he may be able to suggest improvements in methods of production.

Now that manufacturing processes are becoming more specialised and standardised, technical knowledge is more essential in a foreman. That is to say, in the "line," or military type of works organisation, the foreman was more of an organiser than a technical expert.

In this type of management the foreman was usually trained in the shop over which he was subsequently placed in authority. The fact that he was a better workman than his colleagues, and that he possessed tact and loyalty, usually secured for him the position of authority. Now, however, in the "staff," or functional organisation, the foreman must be a technical expert, so that he can convey the orders of the chemist or the engineer to operatives engaged on that particular line, irrespective of departmental or shop authority.

To fulfil his duties and responsibilities in the latter type of organisation, the foreman must not possess technical knowledge only, he must have executive ability, and be able to impart knowledge and convey instructions in a simple and straightforward manner.

In the "line" management organisations, superintendents, as a rule, preferred to make a foreman of one of their own men—that is, a man who had been trained in their own shops. It is quite obvious that this system possesses many advantages. The foreman will be acquainted with the *personnel* of the works, will understand the various trades in the shops, and will be conversant with the firm's methods. Further, if a man is selected from among his fellow-workmen and placed in authority, it will encourage the others, which is not the case if positions of authority are given to "imported" men. Moreover, each man is then given an objective, so to speak.

The writer very well remembers a typical case of a man in the shops who showed he was suited to authoritative control. This man was a first-class mechanic. But, more than this, he was a born leader. Middle-aged, his sane counsels and foresight were constantly being appealed to by younger and less-experienced men. He was generally called upon to arbitrate in quarrels between the men, he was invariably their spokesman at interviews with the management, and was often consulted by the existing foreman on such matters as discipline and manufacturing methods.

When the existing foreman left, this man was promoted, but the authorities were in doubt about placing him over his fellow men. They considered that jealousy and consequent friction would be avoided if he were placed in authority over another department. However, he was tried in his old shop, and proved a complete success. He is now works manager of the same factory.

Various authorities have declared that the position of foreman is one of the most difficult to undertake. When one considers what the majority of managers expect from their foreman, this statement is not surprising. He was considered a very convenient executive to "come down on" if things did not go properly, and some managers did not worry very much if the foreman was provided with the necessary accessories to perform his task in an efficient manner or not.

It is not always necessary for a foreman to be a manipulator, but this quality is always desirable, as a man without it lacks the demonstrative quality when directing operations, which quality is, of course, of more practical utility than any other. Further, the workmen will always respect a man who is better at their jobs than they themselves are far more than they will a man who is an expert organiser and capable of co-ordinating their efforts to obtain the best results, but, at the same time, who lacks the ability to show exactly "how."

Opinion apparently varies from factory to factory on the subject of education as a necessary quality in a foreman. Some managers hold that education is unnecessary as long as the foreman has a thorough knowledge of his trade and possesses executive ability. Others maintain that education is highly important—in fact, is essential in a foreman.

However, most progressive managers, to the writer's knowledge, hold to the former view. That is to say, these managers do not believe that education of a high order is essential to an organiser. Theory alone would not, of course, make a good foreman. Some of the best of this class are men who have been right through the shops from apprenticeship, who have attended evening classes at technical schools, and who are wide readers and students of manufacturing processes and industrial economics.

Foremen, along with works managers, are rapidly becoming more clearly defined—in fact, industrial administration is going to be a definite profession. Some day this will be attained, with degrees and diplomas from an institute formed for the purpose of training organisers on scientific lines, and combining, in their proper proportions, theory and practice.

POWER FACTOR FROM THE BUSINESS MAN'S POINT OF VIEW.

By C. TURNBULL.

Introduction:—The importance of power factor to the commercial welfare of electricity undertakings can hardly be over-estimated. Engineers are now coming to the conclusion that low-power-factor energy must be charged for at a higher rate than the energy taken at unity power factor. The difficulty in doing this is that, so far, it has been found very difficult to explain the meaning of the phrase "power factor" to consumers whose training is of a commercial nature. If one cannot explain it to the consumer, it becomes almost impossible to charge him for it. Engineers have frequently tried to explain it from a technical point of view, but they usually leave the consumer in a hopeless fog, with his mind firmly made up that he will not pay for anything so elusive as wattless current.

In the following article an attempt is made to explain power factor from the business man's point of view. If this method makes it possible to charge consumers for the waste of energy and money involved by low power factor, its inclusion in the columns of the Electrical Review will be justified.

Power Factor Explained Commercially.

If a man were to draw £130 from the bank, and then immediately afterwards return £30, he would be debited with £100. In that respect he would stand in the books just as if he had drawn £100 in the first case, but he would have caused much unnecessary work, and would be a nuisance.

Now certain electric motors act like the undesirable bank customer. Instead of drawing their current from the mains, to convert it right away into useful work, during part of a revolution they draw more current than they need, and return the surplus to the mains during the other part of the revolution.

Thus certain 100-H.P. motors will take 130 H.P. for part of the time, but instead of using the extra 30 H.P., like the undesirable bank customer, they keep putting it back into the mains immediately afterwards.

The effect, therefore, is that the mains must have sufficient capacity to deal with the additional 30 H.P. which oscillates to and fro between them and the motor, in addition to the 100 H.P. actually required, making a mains capacity of 130 H.P. altogether.

An ordinary measuring instrument, in fact, shows a consumption of 130 H.P., but a specially-designed instrument discloses the fact that 30 H.P. is what may be called an oscillating power; that is, instead of being used, it passes into the motor for a short time, and immediately afterwards passes from the motor back again into the mains.

It is, in fact, like the £30 which the man drew from the bank in excess of his requirements, but which he immediately returned.

The banks have recognised that such transactions should not pass without charge. The man who pays, say, £10,000 into the bank, and draws out £11,000 by numerous cheques, leaving an overdraft of £1,000, pays more bank charges than the man who gets a clean overdraft of £1,000. In short, a bank customer pays on his turnover, and not merely on the balance.

Suppliers of electricity have found out that they must follow the precedent set by the bankers. If two consumers have 100-H.P. motors, and if the motor of one takes a clean 100 H.P. from the mains, while that of the other takes an additional 30 H.P., which it immediately returns to the mains, then the first one must have a lower rate than the second.

For the imperfect type of motor the electricity works must lay down, in some cases, hundreds of thousands of pounds'worth of plant which produces no useful effect, but which is merely occupied in dealing with the useless power which oscillates to and fro from the mains to the motors, and back again from the motors to the mains.

To this explanation we may add some technical terms, which consumers will find useful.

The power factor of a motor is the correction which must be applied to give its real power. Thus in the case of the motor which takes 100 H.P. from the mains without any oscillating power at all, the power factor is 100 per cent. All the power is used.

Where the motor takes 130 H.P. from the mains, while it returns 30 H.P. back again as an oscillating power, the power factor is 77 per cent. The reason for this is that if we take 77 per cent. of the apparent power, namely, 130 H.P., we get 100 H.P., which is the real power which the motor absorbs from the mains.

Turning to our analogy, if a bank customer continually presented cheques for sums of £130 at a time, and immediately returned £30 before leaving the bank counter, he might be called a 77 per cent. man, because he only took out 77 per cent. of the money indicated on his cheque.

Users of electric motors may naturally ask if they cannot get motors which will use the energy directly without developing an oscillating current. The answer to this is not only that such motors can be got, but that the imperfect type of motor can be corrected so that it will work without oscillating currents. While these improvements cost money, they bring about a great saving in the cost of supply, which is naturally beneficial to users of electric motors.

These facts have been set out to enlist the sympathies of consumers in the problem, and to get their help to reduce the cost of energy. If the supply authorities have to deal with motors which, as many do, return to the mains as much as half the current which they take, then the plant which supplies the current must cost something like double the money that it would cost if the motors were efficient. Efficient motors mean economy in supply, and that means, what everyone wants—CHEAP ENERGY.

GAS TURBINE DEVELOPMENT.

THE development of an efficient commercial gas turbine is a problem of much interest. In his contribution to a recent discussion at the Institution of Electrical Engineers on the use of producer and blast furnace gases for power production, Mr. Lynn mentioned experiments that had been carried out in Germany on the Holzwarth gas turbine since 1914. We are now able in what follows to give further details of these investigations.

Shortly before the outbreak of war tests were commenced on a 1,000-H.P. vertical gas turbine built by Messrs. Thyssen and Co., at Mülheim, Ruhr. The tests were discontinued during the war, but recommenced in 1918. The Thyssen turbine does not differ in external appearance from the machine previously built at Mannheim, but differs from it in several particulars of design. The tests aimed at the evolution of a simple and effective gas turbine capable of being manufactured in large units, but with a lower cost of production than the steam turbine, including its steam-raising plant.

According to the *Journal* of the American Society of Mechanical Engineers, in which is abstracted Hans Holzwarth's article on the subject published in the *Zeitschrift des Vereines deutscher Ingenieure*, higher charge and explosion pressures were adopted to increase the output per cubic unit of chamber capacity and the thermal efficiency. The average explosion pressure for continuous operation was raised from 12 to 14 atmos. abs., compared with 5 to 6 in the Mannheim machine. Holzwarth thinks it possible to raise this figure still higher by increasing the charge pressure above 2.3 atmos. abs. Curve 1 shows the thermal efficiency (producer gas of 500 kg.-cal. per cu. m.; temp. of mixture, 77 deg. C.), and curve 2 the specific output of the Holzwarth gas turbine (assumed to be free from losses) as a function of the charge pressure previous to the explosion.

The combustion period of the gas turbine is now 0.1 sec., compared with 0.33 sec. for large 90 R.P.M. gas engines and 0.02 sec. for 1,500 R.P.M. aero engines. Fundamentally there is nothing to prevent reducing the expansion period still more, but it would involve an increase of the nozzle cross section, which in turn would lead to an increase in blade length and in flow resistance.

Decreasing the period of expansion increases the pressure on the blades, and the jet in explosion turbines, unlike a steam jet, acts intermittently for short periods, and is of the character of a blow. Because of this new blade shapes and fastenings had to be developed to withstand the added stresses. The blade caps, blades, and blade roots were designed in one piece, as in the De Laval steam turbine, which design has given satisfactory results.

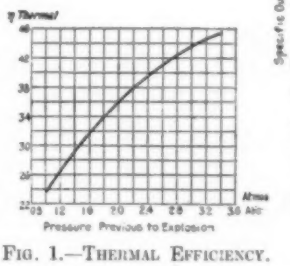


FIG. 1.—THERMAL EFFICIENCY.

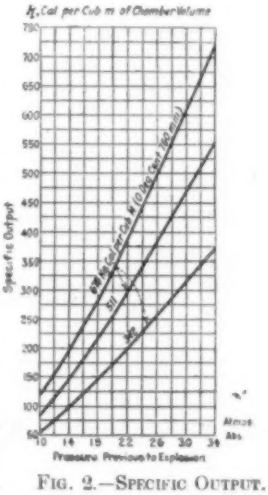


FIG. 2.—SPECIFIC OUTPUT.

Long and expensive tests to determine the most suitable material for the blading led to the adoption of mild electric steel; with proper heat treatment blades of this material proved very satisfactory. Table I shows the physical properties of this steel from tests made at the Technical High School, Stuttgart. While blades made of harder or alloy steels rapidly show changes in structure of the metal, cracks

and fissures, electric steel appears to be capable of withstanding wear and is also resistant against surface corrosion and erosion, provided, however, no substantial amounts of wet steam or water are present in the gases of combustion. The chief difficulty in gas turbines is caused by deterioration of the blades and wheels owing to the high temperature necessary, 600 deg. C. and over, and metals used must be reasonably indifferent to changes of temperature and the action of the gas. Figures relating to other tests made in Germany on alloys for the same purpose are given in the *Mining Journal*, and it is shown that the material which is considered to have the best prospects for use on a large scale in the construction of gas turbines is a nickel-chrome steel (74 per cent. Fe, 20 per cent. Cr, 6 per cent. Ni, 0.3 per cent. carbon). At 600 deg. C. its strength was 47 kilos., with 19 per cent. ductility, and an elastic limit of 16 kilos.; at 700 deg. C. the strength was 24 kilos. and the ductility 7 per cent.; and in an air bath at 700 deg. C. the surface remained free from scale.

With regard to nozzle shapes, on the whole it was found that steam turbine experience applied within reason to the design of gas turbines. Thorough tests on nozzles showed the De Laval type to be satisfactory, provided the angle of

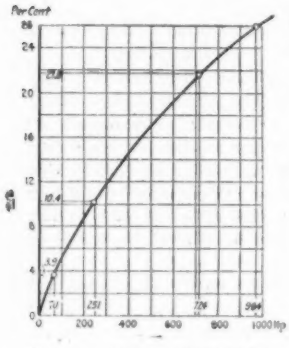


FIG. 3.—TOTAL EFFICIENCY.

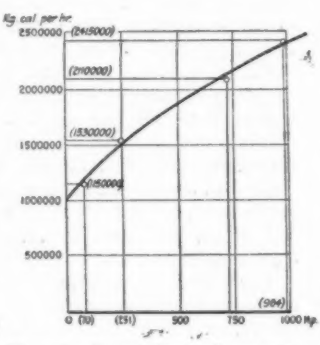


FIG. 4.—TOTAL HEAT SUPPLIED.

outlet is kept as small as possible. The rate of combustion and scavenging were improved by the use of an oil pressure loaded nozzle valve.

If the instantaneous maximum jet velocity at the beginning of expansion is in the neighbourhood of 1,500 m. per sec., more than 95 per cent. of the mechanical energy of the gases of combustion is available at the wheel up to the time when the jet velocity decreases to about 1,000 m. per sec. This means that more than 95 per cent. of the energy is available at jet velocities varying 19 per cent. either way from the average jet velocity for which the nozzle and blading have been designed. Practical experience confirms these theoretical considerations. Efficiencies of about 55 per cent. (*i.e.*, about 55 per cent. of the output attainable in a gas turbine free

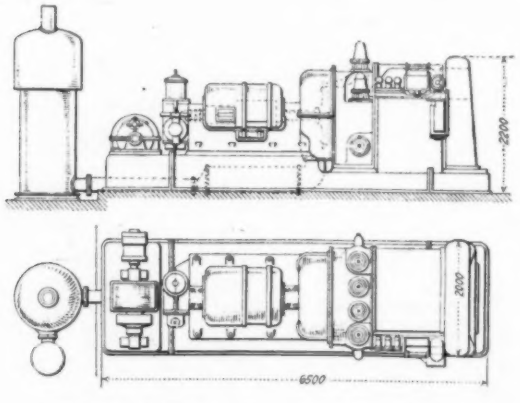


FIG. 5.—A 500-H.P. HOLZWARTH GAS TURBINE.

from all losses) have been indicated on the periphery of the wheel. In gas turbine practice the lower limit of the heat drop is predetermined and for practical purposes so are the peripheral velocity and number of stages. On the other hand, the designer is free to vary the upper limit of the heat drop, and through this the important ratio (jet velocity) : (peripheral velocity) without materially affecting thereby the thermal efficiency of the turbine.

A 4-hour test was carried out in December, 1919, with a gas turbine coupled to a D.C. generator connected to a water rheostat. Coke-oven gas having a calorific value of 3,860 kg. cal. per cu. m. (432 B.TH.U.) was the fuel used. The results are shown in Table II. In the present tests all the combustion chambers were in operation, but in future the governor gear is to be arranged to cut out certain combustion chambers, thus increasing the efficiency on partial loads. Fig. 3 shows the efficiency as measured at the wheel periphery, and fig. 4 the heat supplied, as a function of the power output at the wheel, to the turbine per hour. The work consumed in compressing the blast air and gas amounted to 5.7 per cent. of the exhaust heat, so that the power consumption for the blowers can be well taken care of by exhaust heat.

Gas turbines of the horizontal type appear to be preferable in several ways; working parts are more accessible, and the generator can be kept separate, and it is intended in the future to build only this type.

TABLE I.

——	Tested at	
	Room temperature	450 deg. Cent.
Yield point, kg. per sq. cm.	{ 4,204 / 3,185 }	1,975
Breaking load, kg. per sq. cm. ...	4,510	2,675
Elongation, per cent.	27·2	50·2
Contraction, per cent.	73	88·4

TABLE II.

——	1	2	3	4
Gas consumption, reduced to 0 deg. Cent., and 760 mm. mercury pressure, cb.m. per hour	300	400	550	630
Heat supplied, cal. per hour	1,150,000	1,530,000	2,110,000	2,415,000
Power output at wheel periphery, H.P.	70	251	724	984
Heat consumption, kg-cal. per H.P.-hour	16,430	6,090	2,915	2,450
Effic'ency (periph.) per cent.	3·9	10·4	21·8	26

Fig. 5 shows the outlines of a 500-H.P., 3,000 R.P.M., oil-fuel gas turbine now under construction to drive a D.C. generator. The blower and exciter are built on the same base as the main machine, and directly-connected thereto is the exhaust-heated boiler delivering steam for the blowers. The installation is for the Prussian railway administration.

The original article gives drawings of a 12,000-KW. gas turbo-generator set, and of a 3,300-KW. gas turbine together with blower and waste heat accumulator. It may be added that during the war it was rumoured that a high-efficiency gas turbine had been developed by the Augsburg-Nuremberg Machine Co., but so far the rumour has not been confirmed.

THE ELECTRICAL EQUIPMENT OF ARTISAN DWELLINGS.

AT a meeting of the NORTH MIDLAND CENTRE of the INSTITUTION OF ELECTRICAL ENGINEERS at Leeds, on May 11th, Mr. LEONARD MILNE read his paper on the above subject. This paper was abstracted in our issue of April 9th.

In opening the discussion, Mr. T. B. JOHNSON (Leeds) said that up to the present he had been under the impression that whereas electricity was obviously the best means of lighting a house and providing such small domestic comforts as electric heaters, ironers, and vacuum cleaners, yet when it came to heating, gas was more economical. The Fuel Research Board recently published a table showing that the cost of 100,000 B.TH.U. with gas at 4s. 2d. per thousand feet was 10d. per thousand; and with electricity at 2d. a unit was 58d. That was six times as much for electricity as for gas. They did not want to go too far in recommending electricity if there was a better way. When they wanted a fire for a short time only, they could get the gas fire at a suitable heat much more quickly than they could get an electric radiator of similar size. If they could get the open fireplace completely abolished, the gain from a health point of view would be enormous. If they must have the coal-fire kitchen range, he thought that was the means whereby they should get the supply of hot water. He thought the author in some instances had gone too far in the way of saving first cost, and would lose money in subsequent maintenance. The author proposed to dispense with switch drops, and to place a combined switch and ceiling rose on the wall near the ceiling level, and to operate the switch by a cord or rod

attachment. If that was done, the maintenance costs would soon wipe out the saving on the twin flexible, which was only 40 per cent. on a small sum. The author proposed that the supply from house to house of a group should be made by means of bare overhead wires. There, too, the initial saving would be wiped out by subsequent troubles in maintenance. Where telephone wires were wanted, bare telephone wires and bare electric wires did not go together. The author's suggestion that a group of houses should be taken, and a common charge made on the occupiers, would be quite unworkable. When a number of people shared one meter, even in one firm, there was everlasting trouble in finding out where there had been excessive use of current.

Mr. W. Wraith (Leeds) remarked that the idea of having these groups of houses was a very economical one, and ought to be applied. He did not agree that an extra charge should be made for small domestic apparatus. The electric iron and anything of that sort usually took only a very small current. Electric heating was not as cheap as fiers were now. In his office he had an electric radiator which in the winter took two kilowatts to keep the room fairly comfortable the whole day. The cost at the old price, ¼d., was 8d. for the day, whereas a bucket-full of coal at 8d. lasted them two days.

Mr. W. H. Brown (Shipley) was dubious as to the desirability of the lightly insulated neutral wire, particularly if one came across damp cellars or anything of that sort. It was liable to lead to all sorts of trouble. The voltage of the neutral was not usually much above earth potential, but he had found that in the case of a fault coming on, under certain circumstances, there might be a very considerable increase of potential between earth and the neutral wire. Having one meter for a number of houses might be found quite suitable in the majority of cases. He gave a copy of the paper to one of his workmen, and asked him to talk the matter over with his wife; she thought this electrically-equipped house would be a fine thing if it could only be done; but she said that the gentleman who wrote the paper had entirely forgotten about the washing day. They wanted as much hot water then as they did for the rest of the week. The woman was also up against the idea of having "this chemical business," as she called it—the nitrate of soda and that sort of thing—when the kiddies were about. The question of cost came in. Who was to provide this electrical tackle?

Mr. Davidson (Leeds) said the cost of wiring with twin wires for a heating plug was given as about 18s.; the cost of a moderately good combined switch plug to-day, without any wiring or anything else, was in the region of 18s. Only a few days before, he had to cost up 500 houses on one estate. Those houses were to be wired in screwed tube, with C.M.A. cable, complete with opal shades and lamps, and the prices as they worked out were: For a seven-light house, lighting only, £32 5s.; 8 lights, £25 10s.; 8 lights in blocks of four, £29 10s. per house. The variation in those prices was due to the cost of interconnecting mains. The supply authority proposed to put in one service for each pair of houses, and one service for blocks of four, and it was suggested to interconnect inside by 7/16 mains. Those were the lowest prices at which the work could be carried out. Cleat wiring he did not agree with at all; after the houses had been occupied a week, the wires in the kitchen would be used for hanging up the clothes, and the cost in repairs would be very heavy. The lamps should be fairly high, and probably in the living room should be suspended by a tube rather than a flexible cord. It was desirable that there should be a separate meter for each house; it would encourage people to use special apparatus such as washing machines, irons, and so on, if they could afford them. It was also very desirable to put in a very good type of switch, and that switch should be earthed. The average cost of a house was in the region of £1,000, and if £20 to £25 of that was spent on electric lighting it was a very low figure. The cost of an oven with hot plates suitable for the Yorkshire wife was considerably higher than the cost of the chimneys in the house, which the author gave as £25.

Mr. Innes (Leeds) asked what the author took as the cost—the net cost to the contractor, or the cost to the builder?—Mr. Milne replied that the cost was the price that the contractor would charge, and provided for his establishment charges and profit, for which a provision of 20 per cent. was made. Mr. Innes observed that dealing with it from that point of view, in close-joint conduit with continuity fittings, he did not think the author would to-day be able to do it at anything approaching the cost he had given. His firm was carrying out work at some of those houses, for which the cost was given at 29s., including lamps and fittings. It worked out at that without lamps and shades, and only the cost to themselves. His firm had carried out a good deal of cleat wiring for the Office of Works, but were not satisfied with it; the Corporation would not allow it except as a temporary expedient. After it had been done for a short time they found the wires sagging in all directions. They could considerably cheapen the wiring by the use of a combined switch and ceiling rose; it would practically do away with inspection fittings and tees, which were to-day costing more than 50 per cent. of the cost of the tubing. As regarded the special flexible, the total saving was not a very serious item to put against the danger which would come about through careless workmen putting thinly-insulated flexibles on the live side, or by the owners themselves tinkering with the wiring. As regarded working in conjunction with the architects and builders, it certainly should be done in every case, but it was not, because they often came on to the job very much too late. With regard to service, in a block one service was quite sufficient as a general rule, in a central position. He did not think the running of overhead mains between the blocks could be recommended. In many cases they could dispense with meters where lighting only was required. Two meters ought not to be necessary, if some system of charging like the rateable value system was adopted, he thought it was certainly the best system. There was a big future for electric cooking, once they could educate the public to know that they could save actually on the food alone in cooking; but the people they had to educate in the first instance were those who had the money to pay for the apparatus. The people who were building the artisans' dwellings would not be justified in going to the expense of putting electric cooking apparatus in. Electric washers were very expensive, but no one who had used one would be without one. With regard to heating by electricity, the present type of radiator got hot within a minute, and he did not think they could expect anything quicker than that. For continuous heating it might be more expensive than gas, but for rooms only used for short periods, he did not think there was any question about its being economical, provided they could educate the people into using it in the proper way. He agreed that the best way of getting a hot water supply would be by a separately fired boiler, with anthracite or coke, which was the most economical method they could find, and would probably solve the problem of getting plenty of hot water on washing day, as well. The experience he had had of the thermal storage system so far was unsatisfactory. For linen cupboards a small, low-temperature heater taking about 100 watts was fairly economical. The people they had to educate to the use of electricity first were those who had the money to spend on the apparatus, and they were educating them in that direction with very little trouble, for those electric helps did away with the dependence on servants, and people were becoming more and more converted to their use.

Mr. H. Moss (Bradford) could not see how a house could be wired at £14 in close-joint tubes with continuity fittings. Overhead mains were highly satisfactory for distribution from house to house when blocks of buildings were being put up together; and it was far cheaper than running supply mains through basements in a row of houses. He had been connected with installations where they had adopted overhead mains, cheapening the cost considerably. The wires could be put out of the way by running on the backs of the houses, and would be far more out of sight than if run along the chimneys. In a case he had in mind there were telephone wires; there had been an electric supply for the last ten years, and he had never heard yet of any difficulty arising through the telephone wires coming in contact with the lighting wires. Every customer should pay for what he used, and must have a meter. There were numbers of consumers who would buy these meters outright rather than pay the rental year after year. In the paper the use of all kinds of electric apparatus was advocated; they would have to have separate meters and let those people who used electric radiators and irons pay for what they used. When the author came to suggest that a 9-light installation could be put in for £7, an average cost of 16s. 9d. per light, and that radiator plugs should be put in for 18s. per point, he thought it was impossible to put in wiring that would pass any regulations for that figure. £5 per plug was a common price to-day for radiator plugs in houses, and he did not see how they were going to reduce that price. The smallest radiator it was safe to wire for was a two-unit. They must have cables to suit, a switch of ample capacity, a suitable plug, and separate fuses. It would be a long time before they got electricity adopted universally for heating and cooking in artisans' dwellings.

Mr. Adams observed that gas or electricity had to be put in; the electric installation would be more expensive, but the cost of the gas installation should be taken off that. With regard to co-operation with the architects in building, if they would put wood plugs in and make the runs properly they would considerably reduce the cost in tubing, and tubing would quite easily be put in if all the runs were made out. As regarded the leading-in wires, the overhead proposal had great weaknesses in the way of faults and leakage. Would not it be better to have some system of block wiring, similar to that which the Post Office used at the present time in a large building? The supply was brought up to a pot head outside and branched off to the various offices. A flat rate would undoubtedly lead to extravagance. If £95 would be saved by not making chimneys, an electric installation could be put in for that, therefore why economise on the installation? If they put electric installations in which appeared to be cheap but were not cheap, and did not last, they would do harm to the electrical trade.

Mr. Pickersgill (Cleckheaton) said the Council at Cleckheaton expected to put up 300 houses on the garden city plan. The question of wiring the houses and how the service was to be run was rather a moot point. Going in from the chimney points did not seem to him to be feasible so far as their area was concerned, owing to the sulphur and acids in the air which came up from the dyeworks. The wires would soon be corroded. One man quoted him £5 a light to do about 40 lights in a motor garage. He got it done for

32s. per light, twin lead-covered wire, and a good job too. Five years ago they could wire for £1 a light. They were coming now and wanting £3 a light. They all knew the cost of material had gone up, but it had not gone up as much as the wages and the drop in the amount of work done for the money. Until they could get the workman to do more work in the time, now that he had got his hours lowered, they could not reduce the cost.

Mr. REID (Morley) said he was connected with the housing scheme at Morley, and he would like to point out that the most important question had not been touched upon at all in that discussion. The Housing Commissioner was the most extraordinary barrier to progress. He found that they had got gas in for £12 for a seven-point installation. Unless an electric installation was going to compete with that, he thought it would be almost hopeless to induce the Housing Commissioner to accept it at all. He would propose to bring the wires to the eaves of the buildings, which were mostly about 15 ft. 6 in. from the floor level, and then lead them down to the first-floor level, and take them below the ceiling level through the wall, put the replacement fuses there and the meter, and from there take the wires through the underdrawing, and for the ground floor drop ceiling roses at the various points required. The other points on the first floor, for the bedrooms, might be on the wall sides like gas brackets, and the only switches in the building would be the replacement fuses and a switch at each lampholder or the ordinary key switch. Some years ago he installed lamps with cord attachments to operate them from the ceiling rose, and they proved a complete failure, even with rod attachments. For the bedroom lights there might be, in place of the key switch, ordinary light dimmers or resistances with the combined switch arrangement mounted on the wall-bracket base or on a common plug, which would reduce the cost considerably. Regarding the cost of doing away with chimneys, he did not agree with the author. The average artisan was educated to use the ordinary grate and get plenty of hot water from the ordinary fire and set pot. Regarding gas-heated geysers, three of them were installed at a hospital in Morley, and they were never satisfactory. With regard to cooking apparatus, he did not think those would come in, although he had installed quite a number some twelve years ago at Calcutta, amongst a community educated to the use of electricity. They were not of the artisan type, and they proved quite a success. Open cleat wiring was also a success, and if they could install that in a place like Calcutta where the climate was very damp and the walls got damp, it should suit any other climate. There were practically no fires from cleat wiring; they used to use cleat wiring and tapeless cable manufactured by the General Electric Co., and they all proved quite successful.

Mr. JESSOP (Bradford) said with regard to the author's suggestion to use switches and ceiling roses combined, or fixed together, he had fixed thousands of them in factories, and had some thousands under maintenance at the present time; he found that those switches would last four or five years without any maintenance. That was the usual Wadsworth Tucker fish-tail type with a couple of chains attached. In addition, he liked to put an additional chain on to hold the weight of the lamp, and he did not see any objection to using that in an artisan's dwelling. The artisan had been accustomed to going to the gas and turning on a tap. Relieve him of the match, but give him the tap, and he thought they would make a good job there. With regard to collaborating with the architect, he thought if they did that, contractors would find that it would cost them more, because the architect would put a condition in the contract that as the building was going along they would have to send a man to put in the plugs for the switches. If he put it on to the builder, the builder was going to charge an exorbitant price, because in turn he had to turn it over to his bricklayer and leave him to measure out the exact position and put it in. They had had to do it for some architects, and had to have a man on the job watching the bricklayer. With regard to metering, there was one system that had not been dealt with—the lighting of these artisans' dwellings from A.C. supply, using a condenser for limiting the current. He had had opportunities of inspecting some houses which had been done on that system, and with a charge of 6d. per week the company supplying electricity made a profit. The house had five or six lights, with 50-C.P. lamps in the living rooms and 30-C.P. in the bedrooms, which he thought was equal to what they got with the ordinary incandescent gas. In those houses they had a considerable saving in the charges for meters. He had asked one of the ladies resident in the houses, an ordinary workingman's house, if she was satisfied with the light, because he thought a 50-C.P. lamp would not be sufficient. She said that she was quite satisfied, and preferred the light far above gas. The wiring for that could be done almost entirely with single wiring, simply running a single wire in series round the whole of the house. Instead of being switched out the lights were short-circuited. They could put in a good quality wire, and certainly the cost of seven lights including a condenser, reasonable shades, and lamps, would not come to over £10 10s. for a seven-light installation. For D.C. supply he did not see why a reasonable current limiter should not be used instead of a meter, that would limit the supply, say, to two 50-C.P. or one 50-C.P. and two 25-C.P. lamps.

Mr. FIRTH (Dewsbury) supported the two speakers who had mentioned the question of comparison of costs with gas and the question of the Health Commissioner or Building Commissioner. In Dewsbury there were probably two hundred houses to be built, and they had come on the scene after the prices had been fixed. They had to compete against 12s. 6d. per point for gas. The lowest figure came out at about 25s. per light.

Replying to the discussion, Mr. MILNE agreed that gas was more economical than electricity for heating, but he did not think the question of economy in running cost was of any importance whatever as regarded the heating of such rooms as bedrooms, where the heating would possibly be used for one night in the year. He did not think that they could advocate the electrical heating of rooms that were in constant use. The important point was that if they used gas they must have flues, and practically did not save anything at all on their building, and they had to provide gas stoves for the bedrooms. An electric stove could be carted in when it was wanted, hired from the landlord, and fixed without any noise or fuss at all. They could not do that with a gas stove, it must be permanently fixed and bought and paid for by the landlord. He did not think the maintenance would be at all heavy if the scheme was carried out in its complete form, for the reason that none of the wiring was within hand-reach, and if a cleat wire was run along a ceiling it was not going to be touched except maliciously. Of all the small economies that he had suggested, the one that effected the largest saving was the doing-away with the switch drops. That saved an enormous amount of labour. They should spend money in the factory, and not on the job. One or two speakers had suggested that the thing was not safe. Experience was against that. He could not find that any speaker had ever brought forward at any of the meetings they had had a suggestion that a fire had been coincident with the development of a fault on a system, and surely that must have happened if the want of insulation on the neutral side was a danger. In nine installations out of ten the insulation on the neutral side of a three-wire distribution was practically nil, and when they had to put a neutral side on to an outer, they blew fuses time after time. Artisan dwellings had no cellars at all. Those who had had experience of overhead systems in villages did not find that their bare services were a heavy cost for maintenance. In some cases it might be advisable to run under the eaves and not on the chimneys, and, indeed, in some cases to run through the false roofs of the houses. Each case would have to be dealt with on its own merits. If they looked at the figures which he had suggested for hot water they would find that very fair provision was made for ordinary washing. When he started his paper he thought that the electrical heating of water was not a commercial proposition at all. He was astonished to find that the electrical heating of hot water was cheaper than a separately-run anthracite stove for a small house, and also cheaper than a gas geyser if they provided a pilot burner. If they cut out the pilot burner it was not, but then they had not got anything like the facilities. If one made a comparison between the two, they must make it with a gas geyser fitted with a pilot burner, and he had found to his astonishment that the gas-heated geyser was dearer than an electrical heater. This subject of heating water merited very much greater consideration than had been given to it at present. The figure of 18s. per point for wiring plug points was perfectly sound for the time at which it was given—last autumn. It had to go up because wages had risen, and material had risen a little. It was based on the twin wire that he was suggesting. It would cost a bit more if it was run in a tube or casing or even lead-covered wire. He had allowed for a bed-room, which was a very small room, 1 KW.; and in the scullery, where cooking might go on, 2 KW., and taking the average price all round, it worked out at 18s. per point, providing 20 per cent. for contractors' establishment charges and profit. He did not include in that price the control apparatus of the stove. The prices given for the cost of screwed tube were considerably above his figures. They pointed to the importance of introducing some cheaper form of wiring if they were going to get this work at all. If they had to charge anything like £22 to £29 for wiring an artisan dwelling to-day for lighting only, they would not get it. The landlord, it seemed to him, should bear the cost of cooking apparatus, just as he bore the cost of a coal range, if a range was put into the house. He had found in village supplies for which he was responsible that in some cases where a fixed charge was being made there had been gross extravagance. That sort of thing would have to be stopped. The system he proposed was not going to be unsightly; the wire was about half the diameter of a pencil, run on small cleats close up to the ceiling. It would be very inconspicuous indeed, and distempering would not do any harm. The figure given by Mr. Reid of the cost of the gas installation of seven lights at 12s. per light showed that if they adopted one of those cheap forms they could cut under that price easily. Of that he was convinced. The proposition they wanted to put forward was this: that they could provide the whole advantages of an electrically-equipped house, and save money on the job. They could cover the whole cost of their electrical installation by the saving which they effected in the buildings. When they came to 1,000 or 500 houses of the same pattern, it was worth their while to go carefully into the plan with the architect and fix the positions in which they wanted their fixing blocks.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Ibsco" Battery Steamer and Still.

A simple combined pure water condensing still and generator for steaming the interior of pitch-sealed accumulators preliminary to opening them out for inspection has recently been introduced by the Bailey-Drake Co., of 1,120, South Michigan Avenue, Chicago, U.S.A. The now large and almost universal use of electrically-started and lighted motor vehicles indicates that there is a corresponding scope for apparatus of this kind, at least in garages where motor vehicles are stored and maintained in running order.

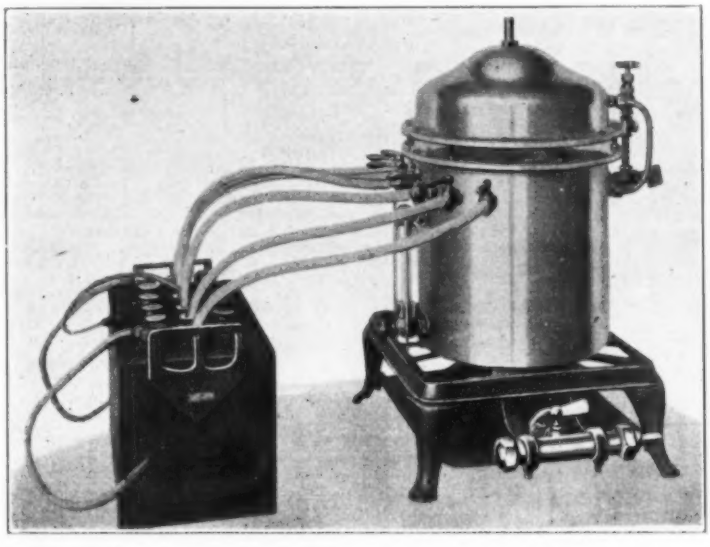


Fig. 1.—The "Ibsco" Battery Steamer and Still.

As will be seen from the accompanying illustration (fig. 1) the apparatus consists of a cast-metal base for a Bunsen gas or other burner, a generator, 18 in. by 10 in., with taps and pipes for leading into the vent plug holes of the respective cells for softening the pitch preparatory to exposing the plates, and superimposed under a cover a coil-still made up of 5 ft. of ¾ in. soft copper tube, the combined generator and still being 21 in. high. The details are of 14 gauge seamless spun aluminium and brass. A low-pressure safety valve and level gauge glass are fitted, and provision made for hand-feeding the generator by connecting it up to a service supply. There is also a load from the still as an outlet for the distilled steam-water into a glass vessel. The weight of the apparatus ranges from 8 to 12 lb. Four varieties are made, viz., with combined steamer and still as illustrated, (2) automatic steamer without still, (3) steamer and still not automatic, and (4) the steamer only.

A Patent Electric Riveter.

The advantages possessed by the electric riveter over the pneumatic and hydraulic types are many and varied. Among them may be mentioned the absence of auxiliary apparatus, and the small power consumption leading to reduced costs. The Mada Engineering Co., Ltd., 12, Bevington Hill, Liverpool, are the makers of the "Remca," a very compact and efficient riveting machine shown in fig. 2. Referring to the illustration, A is a magnet with a plunger B attached to the end of which are side plates bearing three rollers. When the circuit switch is closed the plunger is attracted into the magnet, and the rollers are drawn back along a slide C, and the top roller forces a cast steel lever upwards, causing it to rotate about a pin E. The opposite end of the lever pushes down the riveting ram F, to which is attached the top die for forming the rivet head. When the power is switched off the moving parts are returned to their original position by means of springs. Tests have shown that a ¼-in. iron rivet can be snapped up with a current of 16 amps. at 230 volts D.C. in 3 seconds. This means that one B.O.T. unit is sufficient for 300 of such rivets.

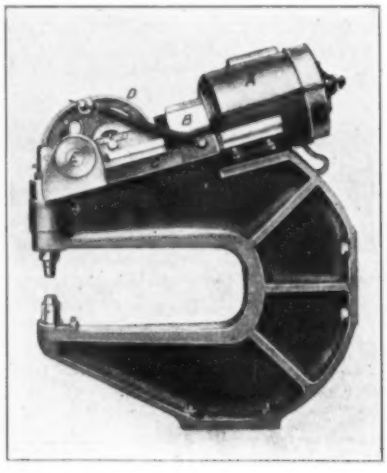


Fig. 2.—"Remca" Patent Electric Riveter.

A G.E.C. Turbine-driven Alternator.

Among the plant installed at the Berthlwyd Colliery, Gowerton, by the General Electric Co., Ltd., was the new turbine-driven alternator shown in fig. 3. The turbine runs at a speed of 3,000 R.P.M., and is directly connected with a 1,000-KW., 3,000-volt, three-phase, 30-cycle alternator. The power factor is .8, and the alternator will maintain a 25 per cent. overload for two hours without excessive heating. The conductor insulating tubes are of micanite moulded on to the coil. The complete coil is pushed through the slots from one end, and for this purpose one end of the coil is left straight. To prevent any movement of the conductors or coils heavy metal clamps with spacing blocks are placed round the windings. The rotor is one solid forging which gives it great mechanical strength. The rotor winding is made up of coils which are completely shaped before they are embedded in slots milled out of the solid drum. The turbine, of compact design, is of the impulse type, and the exhaust steam is dealt with by a Cole, Marchent & Morley condenser. The circulating and air pumps are driven by a 3,000-volt, 50-cycle, 3-phase "Witton" motor of 55 B.H.P.

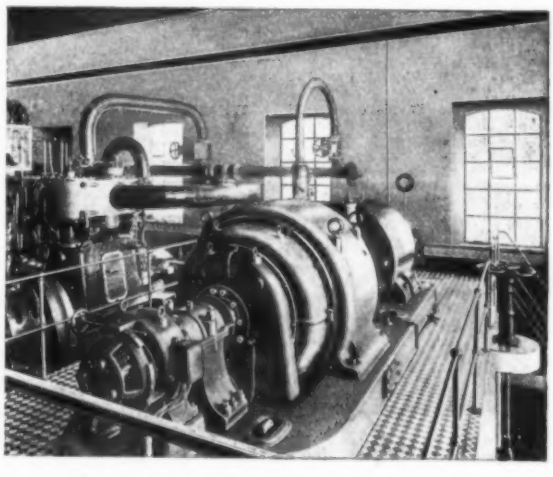


Fig. 3.—G.E.C. Turbine-driven Alternator.

A New Squirrel-cage Rotor.

Referring to the description of their new rotor in our issue of May 14th, Messrs. Higgs Brothers write pointing out that they left the address there given some years ago; the correct address is Sand Pits and Summer Hill Street, Birmingham.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,487. "Electric distributing systems." F. A. Ross. May 17th.
13,490. "Variable electrical resistance." W. Mann. May 17th.
13,491. "Electric motor controlling switchgear." C. C. Garrard, M. Solomon, and W. Wilson. May 17th.
13,516. "Protective fuses for electric circuits." F. W. Uren. May 17th.
13,517. "Means for detecting and indicating defective sparking plugs." S. L. Varvel. May 17th.
13,518. "Electric switches, &c." B. H. Leeson and A. Revrolle & Co. May 17th.
13,538. "Thermionic devices." Western Electric Co. May 17th. (United States, November 1st, 1916.)
13,552. "Spark plugs." J. Bartha and A. E. Glassman. May 17th.
13,572. "Electrodes." Chile Exploration Co. May 17th. (United States, January 21st.)
13,587. "Means for amplifying sounds of receivers or transmitters of telephones." F. H. Gordelier. May 17th.
13,602. "Storage and supply of electrical energy." F. P. Habicht. May 17th. (Switzerland, May 17th, 1919.)
13,622. "Operating-handles of electrical resistance boards, switchboards, &c." F. V. Breeden and Hockley Chemical Co. May 18th.
13,645. "Selecting devices for automatic telephone systems." J. E. Collyer, E. A. Petithory and Siemens Bros. & Co. May 18th.
13,670. "Manufacture of micanite." H. Herrmann. May 18th. (France, September 29th, 1919.)
13,671. "Manufacture of electric insulating material." H. Herrmann. May 18th. (France, November 7th, 1919.)
13,672. "Electric insulating material and manufacture of same." H. Herrmann. May 18th. (France, November 8th, 1919.)
13,673. "Electrical collectors, commutators, &c." H. Herrmann. May 18th. (France, October 29th, 1919.)
13,674. "Electrical collectors, commutators, &c., and manufacture of same." H. Herrmann. May 18th. (France, February 27th.)
13,675. "Electric lighting installations." British Thomson-Houston Co. (General Electric Co.). May 18th.
13,692. "Apparatus for regulating voltage of dynamo-electric machines." A. J. Jullin. May 18th. (France, April 30th, 1918.)
13,694. "High-tension electric depositing-plants." Siemens-Schuckertwerke. May 18th. (Germany, March 31st, 1916.)
13,700. "Electro-magnetic switches." Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). May 18th.
13,714. "Method of generation of electricity from water turbines." C. Y. Lauth. May 18th.
13,721. "Electric faucets." H. K. Clover. May 18th.
13,738. "Electrical plugs." J. A. Romer. May 19th.
13,741. "Electrical measuring instruments." A. Monkhouse. May 19th.
13,753. "Means for applying electricity to the soil for agricultural purposes." W. Bean. May 19th.
13,766. "Sound indicator for protecting users of non-luminous electric heating appliances." G. H. Lofts. May 19th.
13,767. "Electrically-heated articles." G. H. Lofts. May 19th.
13,775. "Electrolytic separation of metals." C. Langer. May 19th.
13,780. "Electrically-heated perforator." A. B. Campbell. May 19th.
13,784. "Starting devices for internal-combustion engines." C. Setterberg. May 19th. (Sweden, February 10th.)
13,793. "Magnetos." D. V. L. Fellows. May 19th.
13,813. "Telephone exchange system." Western Electric Co. May 19th. (United States, July 22nd, 1918.)
13,821. "Thermionic apparatus." F. A. Graham and W. J. Ricketts. May 19th.
13,824. "Control of electric motors." British Thomson-Houston Co. and J. Martin. May 19th.
13,836. "Maximum demand controller and load indicator for electric power installations." D. F. Campbell and C. C. Gow. May 19th.
13,839. "Contrivances for applying metal filament to carrier in electric incandescence lamps." Dr. H. Nahnsen Sprengstoffwerke & Co. May 19th. (Germany, August 11th, 1919.)
13,841. "Trunk circuits for automatic, &c., telephone systems." Automatic Telephone Manufacturing Co. May 19th. (United States, September 18th, 1919.)
13,861. "Incandescent gas burners, electric glow lamp holders, &c." A. C. Jones, Messenger & Son, and S. P. Stubbs. May 20th.
13,867. "Accumulator cases." H. R. Richardson. May 20th.
13,873. "Electric contacts." J. B. Tucker and J. H. Tucker & Co. May 20th.
13,895. "Automatic telephone systems." D. A. Christian and Siemens Bros. & Co. May 20th.
13,905/6. "Duplex electric welding machines." J. Ledwinka. May 20th.
13,909. "Jigs for electrically welding automobile bodies, &c." J. Ledwinka. May 20th.
13,912. "Transformers." J. Ledwinka. May 20th.
13,913. "Method of electrically welding galvanised metal sheets, plates, &c." J. Ledwinka. May 20th.
13,928. "Polarised electric bell." A. Fisk. May 20th.
13,931. "Systems of electric control." British Thomson-Houston Co. (General Electric Co.). May 20th.
13,934. "Telegraph and telephone systems." I. Hortix. May 20th.
13,947. "Electric switches." W. A. Coates and Metropolitan-Vickers Electrical Co. May 20th.
13,955. "Electric accumulators, &c." Greenwood & Batley, H. Leitner and G. E. Wood. May 20th.
13,968. "Apparatus for detecting or translating electric impulses." Radio Communication Co. and J. Scott-Taggart. May 20th.
13,969. "Dynamo-electric machines." P. H. H. Jantzen and Siemens Bros. Dynamo Works. May 20th.
14,015. "Electric motor car lamps, &c." E. G. Sanguinetti. May 21st.
14,031. "Holder for sparking plugs." Burns & Co., J. Byrne and O. Deutsch. May 21st.
14,038. "Electric signalling means." W. P. Thompson (Soc. Francaise Radio-Electrique). May 21st.
14,043. "Wireless directional systems." J. Robinson and R. T. Smith. May 21st.
14,067. "Non-conducting supports for electrical accumulator plates." H. Leitner. May 21st.
14,093. "Electric heater for liquids." E. C. R. Marks (Langguth & Haar). May 21st.
14,097. "Receiving electrical undamped continuous oscillations, &c." Svenska Radioaktiebolaget. May 21st. (Sweden, May 23rd, 1919.)
14,105. "Electrical apparatus for railway signalling." F. Downes and Tyer & Co. May 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

13,760. Signalling in wireless telegraphy. H. L. d'E. Skipworth, H. A. Madge and H. Morris-Airey. September 27th, 1916. (Complete accepted, May 31st, 1917. Patent sealed, May 31st, 1917.) (142,141.)

1918.

17,245. High-tension continuous current dynamo-electric machines. A. Bolliger. October 22nd, 1917. (120,883.)

1919.

1,423. Electro-magnetic apparatus for use in steering moving vehicles. J. G. Gray. August 19th, 1919. (142,164.)
1,991. Electrical connections. H. Garde and C. G. Bennett. January 27th, 1919. (142,175.)
2,038. Construction of magneto-electric machines. G. M. Turner. January 28th, 1919. (142,177.)
2,109. Sparking plugs for internal-combustion engines. J. K. White and Baynes & Partners. January 28th, 1919. (142,180.)
2,121. Ignition and load control for internal-combustion engines. W. W. Bucher. January 28th, 1919. (142,182.)
2,216. Dynamo-battery ignition system. E. H. Hocking and A. W. Pearson. January 29th, 1919. (142,187.)
2,253. Electrical switches. T. W. A. Attwater and Southern Transport Co. January 29th, 1919. (142,190.)
2,254. Magnetic chucks and other magnetic holding-on devices. A. C. Norman and Southern Transport Co. January 29th, 1919. (142,191.)
2,395. Ignition devices for internal-combustion engines. F. A. Smith. January 30th, 1919. (142,196.)
2,396. Ignition devices for internal-combustion engines. F. A. Smith. January 30th, 1919. (142,197.)
2,492. Switch contacts. F. J. Gill. January 31st, 1919. (142,199.)
3,047. Electron discharge devices. British Thomson-Houston Co. (General Electric Co.). February 7th, 1919. (142,207.)
3,301. Electric step-by-step mechanism. C. L. Walker. (142,211.)
3,724. Apparatus for controlling the supply of limited quantities of electric energy. M. Anninger. February 14th, 1919. (142,214.)
3,761. Attachment to the trolley of overhead electric trams, trains and other electric tractors for facilitating the replacement of the trolley on the wire. T. Forsyth. February 15th, 1919. (142,215.)
3,828. Dowel for attaching electric-bell covers, box lids, and other similar purposes. F. E. Wallis and A. E. B. Lloyd. February 17th, 1919. (142,217.)
3,947. Sound-wave concentrators. A. Marr. February 18th, 1919. (142,218.)
4,216. Electric switches. J. A. Crabtree. February 20th, 1919. (142,224.)
4,217. Electric switches. J. A. Crabtree. February 20th, 1919. (142,225.)
4,488. Multiplex telegraphs. G. di L. Pestarini. April 3rd, 1917. (123,758.)
5,012. Switches or apparatus for controlling electric batteries. Accles & Shelvoke and H. F. Steventon. February 28th, 1919. (142,232.)
8,084. Cooling of electric transformers and like apparatus. British Thomson-Houston Co. (General Electric Co.). March 31st, 1919. (142,255.)
8,432. Electric switches for electrically-driven compressing apparatus. C. Melano (F. Borgarello). April 3rd, 1919. (142,260.)
8,751. Telephone systems. Relay Automatic Telephone Co., L. C. Bygrave and T. M. Inman. April 7th, 1919. (142,265.)
10,053. Polyphase electric-heating furnaces. E. C. R. Marks (Armour Fertiliser Works). April 22nd, 1919. (142,283.)
10,096. Regenerative braking system for electrically-driven vehicles, cranes, and the like. K. H. O. Lubeck. April 20th, 1918. (125,988.)
10,608. Protective devices for electrical distribution systems. British Thomson-Houston Co. (General Electric Co.). April 29th, 1919. (142,292.)
10,763. Insulators. British Thomson-Houston Co. (General Electric Co.). April 30th, 1919. (142,295.)
13,663. Magnetic cores and method of making same. B. Ames. May 29th, 1919. (142,329.)
14,068. Electric relays and electric relay circuits. L. B. Turner. June 4th, 1919. (142,333.)
15,047. Induction coils. F. Weatherill. June 14th, 1919. (142,341.)
15,369. Coupling for electric conduits, or for tubes, pipes, shafts, or the like. H. E. Hadwen and H. Willis. June 19th, 1919. (142,343.)
16,118. Electric heating elements. A. Selvatico. June 26th, 1919. (142,349.)
17,148. Arc-welding generators. H. Pollock and T. G. McKay. July 9th, 1919. (142,363.)
17,787. Protective transformer for preventing the passage of currents of dangerously high tension over electric-signalling circuits. A. Perego. July 16th, 1919. (142,367.)
18,119. Method and apparatus allowing a magneto, in a state of rest, to be utilised for starting an explosion engine. N. Herzmark. April 2nd, 1919. (141,008.)
18,829. High-frequency electric-signalling systems. Western Electric Co. (Western Electric Co.). July 29th, 1919. (142,371.)
19,709. Telegraph systems. Western Electric Co. (Western Electric Co.). August 11th, 1919. (142,375.)
19,723. Means of attaching the handle for varying the point of ignition to the interrupter in electric-ignition dynamos. Scintilla. September 13th, 1918. (133,509.)
19,725. Distributors for the high-voltage current of magneto-electric ignition machines. Scintilla. October 1st, 1918. (133,292.)
19,728. Pocket electric lamp. Nurmberger Metall & Lackierwaaren-fabrik Vorm. Geb. Bing Akt. Ges. May 1st, 1915. (131,294.)
24,618. Sparking plug. G. Dubreiul and E. L. Nachon. October 8th, 1919. (142,396.)
25,307. Bar-windings for electric machines. F. Punga and H. Roos. May 4th, 1918. (133,961.)

1920.

1,216. Battery arrangement for small electrically-driven vehicles. R. Slaby. January 22nd, 1919. (138,072.)
5,136. Electric switches. J. A. Crabtree. February 20th, 1919. (Divided application on 140,180.) (142,400.)

Electrically-driven Battleships.—The super-dreadnought *Maryland*, the fourth battleship of the U.S. Navy to be equipped for electrical driving, was launched at Newport News, Va., on March 20th last. This vessel is sister ship to the *Tennessee*, launched in April, and the *California*, launched in November, 1919, at the Mare Island Navy Yard, California, and to the *New Mexico* already in commission. All four ships are similar in size and equipment. The *Tennessee* was expected to be commissioned last month.